Teaching Portfolio

Dipl.-Ing. Dr.tech. Alexander Jung

December 18, 2022

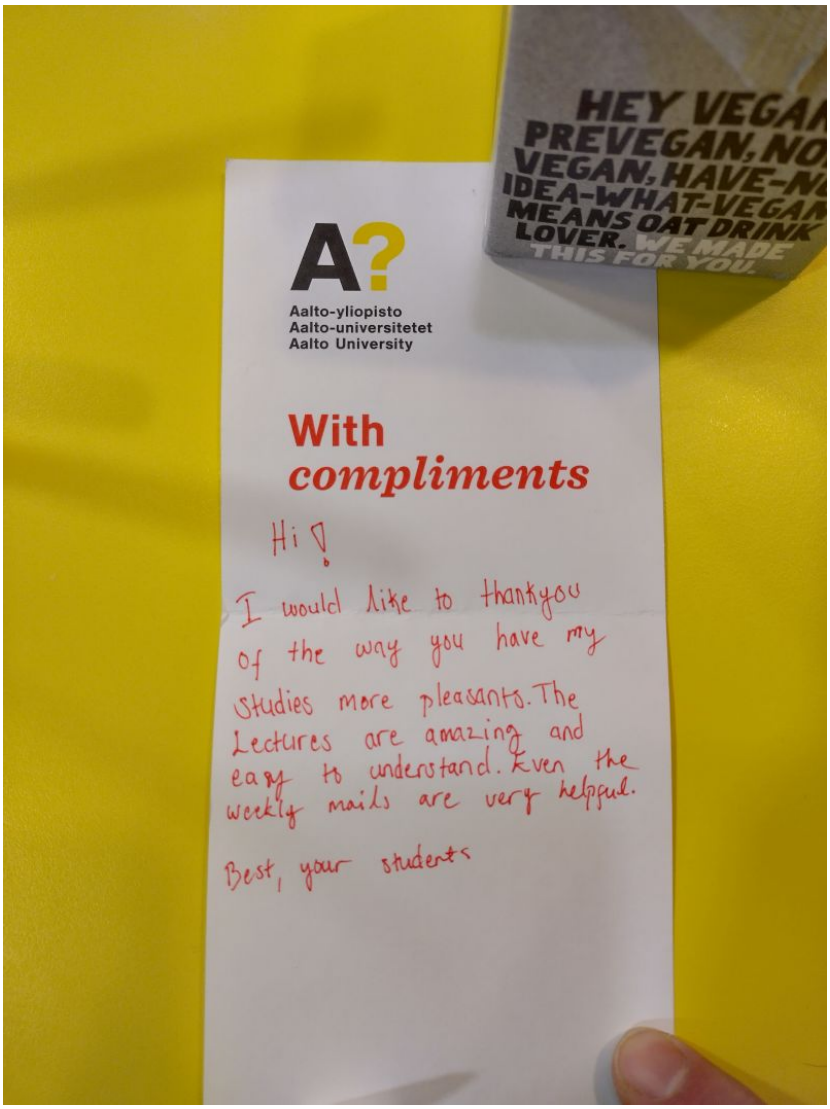


Figure 1. An unexpected and quite uplifting note found in my mailbox during teaching CS-C3240 in spring 2022.

CONTENTS

I. Approach to teaching and learning

My approach to teaching is pragmatic, including the continuous testing and development of new ideas. I have (and still am) learnt (learning) to teach while teaching and learning with students.

A. Conception and Implementation of Teaching

The following list are some observations that I made while teaching several thousands of students within my Machine Learning courses at Aalto university and within the Finnish network university (fitech.io):

- It is important to put effort into preparing (or curating existing) high-quality teaching material such as slides (https://youtu.be/8fsJCyBOizQ), videos (https://youtu.be/8fsJCyBOizQ), Youtube playlists (https://youtube.com/playlist?list=PLrbn2dGrLJK-6OljuWSAYYncEDRSxwieb), Python notebooks (https://github.com/alexjungaalto) or textbooks (https://link.springer.com/book/10.1007/978-981-16-8193-6).
- Do not try to fill a given lecture time slot. A 20-minute lecture on the blackboard that covers the necessary ground for students to get started on an exercise might be (much) more useful than a lengthy 90 minutes slide show.
- It seems useful to have each learning unit (lecture or exercise) start and end with the listing of 3-5 learning goals of this unit.
- Ask students for feedback during course and adapt course accordingly. The official Aalto-wide course survey at the end of the course is not useful for adapting the course on-the-fly to student needs. However, the feedback-adaptation cycle should not be excessive as this might overwhelm students. This is somewhat similar to asking kids for decisions that should be taken by the parent!
- By all means, avoid any changes to the schedule. Students appreciate a firm schedule that is not changed (on short notice).
- It seems that (some) students like lectures just for the sake of the opportunity to gather with other students at a specific place (lecture hall) and time. This observation made me rethink my earlier approach of trying to reduce the number of lecture sessions to the bare minimum (content-wise).
- It is challenging to have students be focused for more than 10 - 15 minutes. I try to ask questions (also in the form of online quizzes) at least every 5-10 minutes.
- I prefer to use coding exercises and student projects for student assessment (grading) instead of pen-and-paper exams. Sometimes I also use multiple choice quizzes to test specific (mathematical) techniques that students should learn. My scepticism towards pen-and-paper exams is mainly rooted in the difficulty of ensuring objective assessment for courses with up to 1000 students and 20-30 teaching assistants that have to assess pen-and-paper derivations.
- A recent teaching tool is a form of ritual that requires students to answer jointly (somewhat like soccer fans singing in a stadium https://www.youtube.com/watch?v=xx0Ru_1zPVk). This ritual tests my three-component-picture of machine learning which is underlying most of my teaching efforts (https://youtu.be/WBYncqztL4c)
- It is important to have students try out concepts by their own. For example, after teaching students the first machine learning method such as linear regression, I let students implement this method themselves using a Python notebook. These exercises can be implemented conveniently using our JupyterHub server (https://jupyter.cs.aalto.fi/) that allows students to write programs via a web-browser. In particular, students do not need to install any programming language themselves.
- You will typically never have enough resources to implement your dream (optimal) version of a course. Thus, being a teacher means to be able to manage limited (or lack of) resources.

B. Justification for why I teach the way I do.

Evidence for Effectiveness of my Approach. The main evidence for the effectiveness of my teaching approach is the numerous praising of students within the Aalto-wise course feedback system. I have included the feedback reports for recent courses in Appendix B and list here some examples that I consider most relevant.

- "*... I liked that this course had a clear message and I think that everyone can now name the three components of ml. It would be nice if all university courses could...*"
- "*..I will definitely never forget the three main components of machine learning....*"

- "*... Remembering three main components of ML every lectures is good, as I now remember them very well....*"
- "*The book MLBasics by Alex Jung is extremely helpful.*"
- "*Lectures and materials (ML: The Basics by Alexander Jung) were excellent.*"
- "*Lectures were really great on this course, especially the ones lectured by professor Alex Jung.*"

I also point out the excellent student ratings for the teaching methods aspect in the feedback surveys (see Appendix B). As a case in point, Figure 2 demonstrates the significantly improved student rating of the course "Machine Learning: Basic Principles" which I took over right from my start at Aalto in 2015. The final edition in 2018 was taught by me as the only teacher and then achieved its highest rating.

Figure 2. Student rating of the course "Machine Learning: Basic Principles" (running under a different course codes in 2015) as collected by the Aalto survey system during course edition in fall 2015 (I started my tenure-track position at Aalto University in August 2015!) and in fall 2018.

Means to be reflective and purposeful. Careful study of student feedback and its utilization to continue growing as a teacher. I have tried to prepare response letters to student feedback received in each course (see Appendix C for examples of these response letters). It is quite an effective means for reflection to sit down, read through the student feedback and prepare the response letter.

My criteria to assess quality and effectiveness of my teaching. The main formal criterion is the student feedback (see Appendix B). Another criterion is the invitation to teach outside Aalto University. I have just been invited to teach a two-day course on Machine Learning within the EU MSCA European Joint Doctoral Programme in Plenoptic Imaging (https://cordis.europa.eu/project/id/956770). Thus, it seems that I have already a reputation as an excellent teacher for machine learning beyond Aalto University. Another source for quality indicators is provided by the statistics of my Youtube channel. One of my lecture videos has already been viewed some 6500 times (https://youtu.be/8fsJCyBOizQ). Finally, the quality of my teaching might also be reflected in the compensation that I can ask for seminars or short-courses (around 2500 Eur per day).

Evidence on reflections in every day work as a teacher. See Appendix C.

Reflection on how my approach to teaching has developed over the years. In the beginning, my teaching mainly focused on domain expertise and was based on existing material (textbooks, slides). However, I have found that the traditional approach of teaching machine learning was not suitable to cope with the increasing demand for machine learning education. In particular, many students in my machine learning courses have typically only basic knowledge of statistics and real-valued analysis. Therefore, I have developed a radically new approach to teaching machine learning. This approach decomposes machine learning methods into design choices for data representation, model and loss function. Identifying these three components (data, model, and loss) allows exploring the vast landscape of machine learning methods without requiring students first to learn about advanced concepts of statistics and continuous optimization. My efforts in developing a new machine learning pedagogy have culminated in the textbook

A. Jung, "Machine Learning: The Basics,", Springer, Singapore, 2022. available via Aalto library.

II. Teaching Experience

A. Coverage of educational experience

Experience and responsibilities in teaching. Description of my role and contribution.

I have served as the **main teacher** for the following courses at Aalto University:

- CS-C3210 "Machine Learning: Basic Principles"; developed significantly further after taking over in 2015; co-teachers: Dr. Jorma Laaksonen (2015), Dr. Markus Heinonen (2016-2017). This course achieved its highest student rating in the 2018 edition when I was teaching the course as the only teacher. This course development resulting in the textbook

  Jung, A. (2022). Machine Learning: The Basics. (Machine Learning: Foundations, Methodologies, and Applications). https://doi.org/10.1007/978-981-16-8193-6
- CS-C3240 "Machine Learning"; created from scratch; co-teacher Prof. Stephan Sigg; almost 1000 student registrations from all six schools of Aalto University.
- CS-EJ3211 "Machine Learning with Python"; created from scratch; co-teacher Dr. Shamsiiat Abdurakhmanova; most popular course at https://fitech.io/en/ !
- CS-E4800 "Artificial Intelligence"; created from scratch; co-teacher Dr. Tomi Janhunen;
- CS-EJ3311 "Deep Learning with Python"; created from scratch; co-teacher Dr. Shamsiiat Abdurakhmanova
- CS-E4740 "Federated Learning"; created from scratch; (pilot was offered as"Special course in Machine learning and Data science: Networked Federated Learning, Lectures" in 2022.)
- CS-E4020 "Convex Optimization for Big Data"; created from scratch; course material resulted in the review paper

  Jung A (2017) A Fixed-Point of View on Gradient Methods for Big Data. Front. Appl. Math. Stat. 3:18. doi: 10.3389/fams.2017.00018
- Summer school "Human-centered Machine Learning" (2022), created from scratch;

Substance-related teaching activities at other educational institutions nationally and internationally. I have been also very active in teaching short courses (boot-camps) for different adult-learner providers.

- My courses CS-EJ3211 ("Machine Learning with Python") and CS-EJ3311 ("Deep Learning with Python") are among the most popular courses at the **Finnish network university** https://fitech.io/en/.
- Main teacher for the "Machine Learning" program 2019-2020 at https://www.integrify.io/
- Main teacher for the two-day "Machine Learning and Artificial Intelligence Workshop" during Sept. 2019 offered at Salo IoT campus https://www.saloiotcampus.fi/fi/tapahtuma/255/koneoppimisen-ja-keinoalyn-workshop
- I served as main teacher for the Summer school "Human-centered Machine Learning" (2022) within the **University Network for Innovation, Technology and Engineering (Unite!)**, https://www.unite-university.eu/whatsnew/learn-the-essentials-of-machine-learning-systems-this-summer
- Two-day course on "Machine Learning" within the European Plenoptima Training School 2 on "Machine and Deep Learning for Plenoptics" https://plenoptima.eu/ts2/programme/

Positions as an expert in executive education and non-university substance related education or training I am very active in the development and delivery of executive education programs.

- Main faculty of the training program "Diploma in Artificial Intelligence" offered yearly by Aalto Executive Education, 2019 - 2022.
- Faculty lead for the training program "Aalto-SUTD Modular Master in Technology and Management" offered by Aalto Executive Education Academy Pte Ltd (Singapore).
- Faculty lead for the tailored training program "Swedish NAO Data Science Program" offered by Aalto Executive Education during 2022-2023.

Experience in collaborating with colleagues in teaching courses/modules /programmes.

Extensive and instrumental for my growth as a teacher and educational leader. I also strongly encourage you to reach out to my co-teachers, which can be found from the corresponding course pages, and ask them for their experience.

How my experience-based knowledge is contributing to my teaching competence and student learning outcomes (especially if you have extensive teaching experience) Profoundly. I try to extract maximum information from my experience,

such as student feedback, to develop my teaching competence further. In this regard, I cordially invite you to read samples of response letters included in Appendix C.

B. Role in thesis supervision (e.g. supervising, advising, assisting)

Post-Doctoral Students.

- Y. Tian (2021-)
- S. Abdurakhmanova (since 2020, Aalto School of Science TA of the Year 2020)
- L.A. Carafi (2019-2021, now with Finnish meteorological institute (FMI))
- N. Vesselinova (2018, now with Centre Tecnologic de Telecomunicacions de Catalunya)
- S. Aridhi (2016, now Assoc. Prof. at University of Lorraine),

Doctoral Students.

- X. Yang (2022 -), tentative thesis topic "Machine Learning over Networks", partially funded by China Scholarship Council
- D. Pfau (2022-), working on "Machine Learning Law", jointly supervised by Prof. Katri Havu (Faculty of Law, UH, https://researchportal.helsinki.fi/en/persons/katri-havu)
- A. Tilanterä (2021-), working on "Teaching Computer Science with Visualization and Automatic Feedback", jointly supervised by Prof. Lauri Malmi (https://people.aalto.fi/lauri.malmi)
- L. Zhang (2020-2022), working on "Explainable Machine Learning", partially funded by China Scholarship Council
- R. Tervo (2017-2021), thesis "Machine Learning-Based Weather Impact Forecasting" defended Nov. 2021, Opponent: Prof. Kai Puolamäki from University of Helsinki, fully funded by the Finnish Meteorological Institute (FMI)
- N. Tran (2016-2020), thesis "Machine Learning for Networked Data" defended Feb. 2020, Opponent: Prof. Joakim Jalden from KTH Stockholm
- T. Huuhtanen (2017-), working on "Predictive Maintenance for Solar Panels"
- J. Sui (2018-2019) working on "Clustering of Streaming Data", fully funded by China Scholarship Council
- W. Menghao (2018-2019) working on "Reinforcement Learning over Continuous Domains", fully funded by China Scholarship Council

Master Theses. Pls see the corresponding entry in the Aalto library for my precise role (supervisor, advisor).

1) T. Sormunen, *Pallet Detection in Warehouse Environment*, Aalto U., in progress.
2) R. Tikkanen, *Machine learning for Fitness Tracker Data Integration*, industry: https://fjuul.com/, Aalto U., in progress.
3) T. Rahman, *Deep Learning based Intrusion Detection System*, Aalto U., August, 2022.
4) T. Gyabaah, *Machine Learning for Art Fraud Detection*, industry: https://www.blankt.com/, Aalto U., July, 2022.
5) J. Lillfors, *Networked Federated Learning*, Aalto U., July, 2022.
6) A. C. Barcsa-Szabo, *Feature-based Approaches for Ethical News Personalization*, industry: Sanoma Media Finland (https://media.sanoma.fi/), Aalto U., July, 2022.
7) C. Molinero Ranera, *Multi-label classification of a hydraulic system using Machine Learning*, Aalto U., July, 2022.
8) V. Petrutiu, *Exploring Transformers and Degradation Methods in the Super Resolution Field*, industry: Huawei, Aalto U., July, 2022.
9) P. Truong, *Crown-of-Thorns Starfish detection by state-of-the-art YOLOv5*, Aalto U., July, 2022.
10) Y. Huang, *Text analysis of novel coronavirus pneumonia based on federal deep learning*, Aalto U., June, 2022. https://aaltodoc.aalto.fi/handle/123456789/115546
11) C. Ozen, *A collaborative approach for large-scale Electricity consumption using Federated Learning*, Aalto U., June, 2022. https://aaltodoc.aalto.fi/handle/123456789/115282
12) P. Prinsen, *Robust Gas pressure control using Neural Networks*, industry: Wärtsilä Finland Oy, Aalto U., Jan., 2022. https://aaltodoc.aalto.fi/handle/123456789/112627
13) E. Hattula, *Transfer Learning Technology for Building Extraction from Orthophotos and Open-Source Data*, industry: National Land Survey of Finland (https://www.maanmittauslaitos.fi/en), Aalto U., Jan., 2022. https://aaltodoc.aalto.fi/handle/123456789/112450
14) A. Channabasaiah, *Applying machine learning methods to predict taxi pickups using historical taxi data*, Aalto U., Jan., 2022. https://aaltodoc.aalto.fi/handle/123456789/112871

15) R. Hellström, *Aspect Based Sentiment Analysis in Finnish*, industry: Crowst Oy, Aalto U., Jan., 2022. https://aaltodoc.aalto.fi/handle/123456789/112857
16) M. Leinonen, *Federated Multi-task Learning over Networked Data*, Aalto U., June, 2021. https://aaltodoc.aalto.fi/handle/123456789/108261
17) M. Uutaniemi, *Extraction of labeled fields from images of structured documents*, Aalto U., Aug., 2021. https://aaltodoc.aalto.fi/handle/123456789/109305
18) A. Orre, *Pedestrian movement analysis from drone perspective*, Aalto U., Dec., 2021. https://aaltodoc.aalto.fi/handle/123456789/111730
19) P. Vijayakrishnan, *Semi-supervised machine learning techniques for infant motility classification*, Aalto U., Oct., 2021. https://aaltodoc.aalto.fi/handle/123456789/110565
20) J. Seppälä, *Application of machine learning to link click predictions in Facebook Family of Apps advertising*, Aalto U., 2021. https://aaltodoc.aalto.fi/handle/123456789/106829
21) K. Kutlu, *Machine Learning based Chaos Engineering for Cloud-Native Microservice Architectures*, industry: Ericsson, Aalto U., Aug., 2021. https://aaltodoc.aalto.fi/handle/123456789/109355
22) K. Ariko, *Increasing the safety in the proximity of the mobile working machines: a study of detecting people*, industry: Epec Oy, Aalto U., Oct., 2021. https://aaltodoc.aalto.fi/handle/123456789/110498
23) M. Afteniy, *Predicting time series with Transformer*, Aalto U., May, 2021. https://aaltodoc.aalto.fi/handle/123456789/107662
24) Z. Mohammadi, *Better Utilization of Relational Data in Machine Learning*, industry: Lamia Oy, Aalto U., May, 2021. https://aaltodoc.aalto.fi/handle/123456789/107604
25) T. Nguyen, *Applying Machine Learning to Develop Black-box Control Model of Active Double-Skin Facade*, Aalto U., Jan., 2021. co-supervised with Prof. H. Ihasalo, https://aaltodoc.aalto.fi/handle/123456789/102547
26) P. Pyrrö, *AIR: Aerial Inspection RetinaNet for Land Search and Rescue Missions*, industry: Accenture, Aalto U., Jan., 2021, https://aaltodoc.aalto.fi/handle/123456789/112856
27) T. Kokkonen, *Classifying Restaurant Menu Items With Supervised Learning*, Aalto U., Jan., 2021. https://aaltodoc.aalto.fi/handle/123456789/102433
28) C. Dikmen, *Application of Contextual Bandits Models in a Supervised Learning Setting*, Aalto U., Aug., 2020. https://aaltodoc.aalto.fi/handle/123456789/46314
29) J. Laiho, *Recognizing Thoughts from Bioelectric Patterns? A Brain-Computer Interface with Deep Learning*, industry: Accenture Liquid Studio (NL), Aalto U., Aug., 2020. https://aaltodoc.aalto.fi/handle/123456789/46105
30) X. Zhang, *Diagnostic and Prognostic Analysis Optimization of Field Problems for EV Charging Stations*, industry: ABB, Aalto U., Aug., 2020. https://aaltodoc.aalto.fi/handle/123456789/46045
31) T. Hämmäinen, *Clustering IoT devices for network intrusion detection systems*, industry: Ericsson, Aalto U., May, 2020. https://aaltodoc.aalto.fi/handle/123456789/44266
32) T. Valentijn, *The Practical Applicability of a CNN for Automated Building Damage Assessment*, industry: Red Cross NL (https://www.510.global/), Aalto U., June, 2020. co-supervised with Dr. Jorma Laaksonen, https://aaltodoc.aalto.fi/handle/123456789/44991
33) J. Nieminen, *Framework for application of machine learning algorithms in telecommunications*, industry: Nokia Oyj, Aalto U., Mar., 2020. https://aaltodoc.aalto.fi/handle/123456789/43572
34) M. Mishin, *Anomaly Detection Algorithms and Techniques for Network Intrusion Detection Systems*, industry: Ericsson, Aalto U., Aug., 2020. https://aaltodoc.aalto.fi/handle/123456789/46076
35) D. Tokmurzina, *Road marking condition monitoring and classification using deep learning for city of Helsinki*, Aalto U., Oct., 2020. https://aaltodoc.aalto.fi/handle/123456789/47388
36) I. Vikström, *Deep reinforcement learning approach for HVAC control*, industry: TietoEVRY Oyj, Aalto U., Dec., 2020. https://aaltodoc.aalto.fi/handle/123456789/97613
37) K. Klemets, *Forecasting Hourly Parking Occupancy with Multiple Seasonalities*, industry: City of Helsinki, Aalto U., Aug., 2020. https://aaltodoc.aalto.fi/handle/123456789/45990
38) J. Moisala, *Optimizing the mark-up of foreign exchange derivative contracts using machine learning*, Aalto U., May,

2020. https://aaltodoc.aalto.fi/handle/123456789/44353

39) L. Kolehmainen, *A web scraping system for extracting news articles*, industry: Vainu Finland Oy, Aalto U., Dec., 2019. https://aaltodoc.aalto.fi/handle/123456789/41693
40) T. Wiro, *Market influence on purchase prices in procurement*, industry: Sievo, Aalto U., June, 2019. https://aaltodoc.aalto.fi/handle/123456789/39059
41) J. Eskonen, *Deep Reinforcement Learning in Automated User Interface Testing*, industry: Ericsson, Aalto U., May, 2019. https://aaltodoc.aalto.fi/handle/123456789/37895
42) A. Moskalev, *Demand forecasting for fast-moving products in grocery retail* , industry: Relex, Aalto U., May, 2019, https://aaltodoc.aalto.fi/handle/123456789/37915
43) D. Baad, *Automatic Job Skill Taxonomy Generation For Recruitment Systems*, industry: VXT Research Oy, Aalto U., June, 2019. https://aaltodoc.aalto.fi/handle/123456789/38986
44) K. Karapetyan, *Process Mining of Automation Services with Long Short-Term Memory Neural Networks*, industry: Posti Group Oyj, Aalto U., March, 2019. https://aaltodoc.aalto.fi/handle/123456789/37178
45) J. Kahles, *Applying Machine Learning to Root Cause Analysis in Agile CI/CD Software Testing Environments*, industry: Ericsson, Aalto U., Jan., 2019. https://aaltodoc.aalto.fi/handle/123456789/36347
46) H. Ambos, *Semi-Supervised Learning over Complex Networks*, Aalto U., Mar., 2019. https://aaltodoc.aalto.fi/handle/123456789/37130
47) M. Torres Porta, *Anti-Money Laundering system based on customer behavior*, Aalto U., Aug., 2019. https://aaltodoc.aalto.fi/handle/123456789/39938
48) A. Shehata, *Cellular Network Average User Throughput-Downlink Prediction by Machine Learning*, industry: Nokia, Aalto U., Dec., 2018. https://aaltodoc.aalto.fi/handle/123456789/35471
49) O. Abramenko, *Graph signal sampling via reinforcement learning*, Aalto U., Nov., 2018. https://aaltodoc.aalto.fi/handle/123456789/34750
50) M.O. Nasir, *Supervised Learning in Lighting Control Systems*, Aalto U., Oct., 2018. https://aaltodoc.aalto.fi/handle/123456789/34394
51) D. Wu, *Unsupervised Learning for Lighting Control System*, industry: Helvar Oy, Aalto U., Oct., 2018. https://aaltodoc.aalto.fi/handle/123456789/34384
52) N. Pokhrel, *Drone Obstacle Avoidance and Navigation Using Artificial Intelligence*, industry: Nokia, Aalto U., May, 2018. https://aaltodoc.aalto.fi/handle/123456789/31561
53) D. Koskeniemi, *Do financial networks improve the explanatory power of the Fama-French factors? A comparison of propagation algorithms on stock market returns* , Aalto U., March, 2018. https://aaltodoc.aalto.fi/handle/123456789/30542
54) S.B. Jahromi, *Compressed Sensing for Big Data Over Complex Networks*, Aalto U., Jan., 2018. https://aaltodoc.aalto.fi/handle/123456789/29671
55) A. Mara, *A Comparative Analysis of Graph Signal Recovery Methods for Big Data Networks*, Aalto U., Oct., 2017. https://aaltodoc.aalto.fi/handle/123456789/28567
56) Y. Gao, *Graphical Model Selection in Big Data Application*, Aalto University, Dec., 2016. https://aaltodoc.aalto.fi/handle/123456789/23908
57) B. Kausl, *Channel aware inference based on the Fisher information*, TU Vienna, 2012. co-supervised with Prof. Franz Hlawatsch,, http://hdl.handle.net/20.500.12708/8885

The methods in supervising. Pragmatic and adaptive to the specific student need. I found it useful to ask students to do a self-assessment of their thesis. This self-assessment uses the same format and grade characterizations (see, e.g., https://mycourses.aalto.fi/course/view.php?id=19277&section=9 for master thesis) that are used by myself in the actual thesis evaluation. Sometimes I also encourage students to peer-review each others work. However, this is not always possible as students are in different stages of their thesis work. In general, I try to make students aware that reading (peer-reviewing) is at least as important as the writing component in scientific communication.

My development as a supervisor. Significant and continuous. It is important to clearly communicate the expectations form the supervision relationship. The student must be made aware that the role of a supervisor is not that of a co-author. I find it also crucial to keep a professional distance, and not try to be the "friendly professor", such that (potentially uncomfortable)

critique is not misunderstood as a personal offence.

Creating, renewing or upgrading of course material. Continuously based on student feedback. I mainly document the renewal and upgrading of course material in my response letters (see Appendix C). Technically, the continuous renewal and upgrading of my course material is documented by version control system (version.aalto.fi) at Aalto University. I cordially invite the SCITEC members to inspect the history of the relevant repositories

- for CS-EJ3311: https://version.aalto.fi/gitlab/jupyterhub-courses/dlpython/-/commits/master
- for CS-EJ3211: https://version.aalto.fi/gitlab/junga1/mlpythondev
- for CS-C3240: https://version.aalto.fi/gitlab/junga1/cs-c3240/-/commits/main
- for my textbook: https://version.aalto.fi/gitlab/junga1/mlbasicsbook

Pedagogical considerations when preparing and using these materials. These materials are meant to optimally support student learning during lectures, exercises and independent study.

III. Curriculum development and educational leadership

I have been the main driver behind the renewal of the machine learning curriculum at Aalto University (and beyond). The courses developed by me and my co-teachers are the backbone of machine learning programs at Aalto University, fitech.io and Aalto Executive Education. My courses have also been a main driver for the Jupyterhub server https://jupyter.cs.aalto.fi/ which is now used by numerous other courses for implementing programming exercises. I am also ready to take a more formal role as program head.

IV. Development as a Teacher

Significant and continuous.

A. Record of pedagogical studies.

I was too busy with actually teaching some of the largest and most successful courses at Aalto University. However, I look forward to use more time for formal pedagogical studies instead of teaching large machine learning courses in the future.

B. Key learnings from pedagogical studies and development of teaching skills

How you maintain and enhance your pedagogical competence. By carefully observing my students as well as other teachers to learn from them.

How you identify your strengths and development areas as a teacher. Considering students as the first-class citizen at a University instead of nuisance that keeps a Professor from polishing publications and funding applications.

V. Student and peer feedback

A. Student feedback; evidence based on courses delivered

I cordially invite the reader to consult Appendix A and B for summary statistics and more detailed student feedback for some of my courses. The reponse letters in Appendix C may provide evidence for how I used the feedback to develop my teaching over time.

B. Peer feedback of fellow teachers, superiors

I cordially invite the reader to consult Appendix D for some (formal) peer feedback.

C. Credentials and rewards received

- Teacher of the Year at the Department of Computer Science, 2018.

APPENDIX A
COURSE STATISTICS

Aalto University

Aalto University - Course feedback
Report created 30.8.2022 13.02.
Questionnaires opened between 4.8.2012 and 31.8.2022.
Email: coursefeedback@aalto.fi.

My overall assessment of the course

1 = Fair, 2 = Satisfactory, 3 = Good, 4 = Very good, 5 = Excellent

Course	Teacher	Start date	End date	Enrolled students	Respondents	Response %	Average
CS-EJ3211 Machine Learning with	Alex Jung	9.9.2019	4.12.2019	475	65	14 %	3,9
CS-EJ3311 Deep Learning with	Alex Jung	9.9.2020	18.12.2020	504	173	34 %	4,0
CS-E4800 Artificial Intelligence D	Alex Jung, Tomi Janhunen	4.1.2018	5.4.2018	418	259	62 %	3,5
T-61.3050 Machine Learning: Basic Principles	Alex Jung, Hamidreza Tavakoli, Jorma Laaksonen	7.9.2015	4.12.2015	224	112	50 %	3,3
CS-EJ3211 Machine Learning with	Alex Jung	7.1.2020	3.4.2020	428	136	32 %	4,1
CS-EJ3211 Machine Learning with	Alex Jung	7.9.2020	11.12.2020	557	187	34 %	4,1
CS-EJ3211 Machine Learning with	Alex Jung	4.5.2020	31.7.2020	548	121	22 %	4,2
CS-E4070 Special Course in Machine Learning and Data Science D	Alex Jung	15.4.2020	27.5.2020	28	3	11 %	< 5 respondents
CS-E3210 Machine Learning: Basic Principles D	Homayun Afrabandpey, Rao Anwer, Markus Heinonen, Tolou Shadbahr, Viivi Hallaaho, Alex Jung (responsible), Ricardo Falcon Perez, Nguyen Tran Quang, Cristina Gonzalez Caro	13.9.2017	8.12.2017	462	234	51 %	3,3
T-61.6020 Special Course in Computer and Information Science	Sabeur Aridhi, Sahely Bhadra, Alex Jung	11.4.2016	18.5.2016	31	7	23 %	4,0
CS-E3210 Machine Learning: Basic Principles D	Markus Heinonen, Alex Jung (responsible)	13.9.2016	21.10.2016	342	215	63 %	3,5
CS-E3210 Machine Learning:	Alex Jung	11.9.2018	29.10.2018	774	594	77 %	4,0
CS-E4020 Special Course in	Alex Jung	22.2.2017	17.5.2017	49	34	69 %	4,1
CS-EV Course with Varying	Alex Jung, Petri Vuorimaa	15.4.2019	15.6.2019	113	45	40 %	3,7

Aalto University

Aalto University - Course feedback
Report created 30.8.2022 13.02.
Questionnaires opened between 4.8.2012 and 31.8.2022.
Email: coursefeedback@aalto.fi.

CS-EJ3211 Machine Learning with Python D	Alex Jung, Shamsiiat Abdurakhmanova	29.3.2021	4.6.2021	332	35	11 %	3,9
CS-EJ3211 Machine Learning with Python D	Alex Jung, Shamsiiat Abdurakhmanova	11.1.2021	26.3.2021	313	65	21 %	3,8
CS-C3240 Machine Learning D	Stephan Sigg, Alex Jung	11.1.2021	26.3.2021	872	463	53 %	3,3
CS-EJ3311 Deep Learning with Python D	Shamsiiat Abdurakhmanova, Alex Jung	13.9.2021	17.12.2021	299	48	16 %	4,1
CS-C3240 Machine Learning D	Alex Jung, Stephan Sigg, Yu Tian	10.1.2022	8.4.2022	904	425	47 %	3,6
CS-EJ3211 Machine Learning with Python D	Alex Jung, Shamsiiat Abdurakhmanova	10.1.2022	8.4.2022	273	55	20 %	4,2
Special course in Machine learning and Data science: Networked Federated Learning,	Alex Jung	28.3.2022	3.6.2022	23	1	4 %	< 5 respondents
CS-EJ3211 Machine Learning with Python D	Shamsiiat Abdurakhmanova, Alex Jung	4.4.2022	4.7.2022	107	18	17 %	4,2

APPENDIX B
DETAILED COURSE FEEDBACK

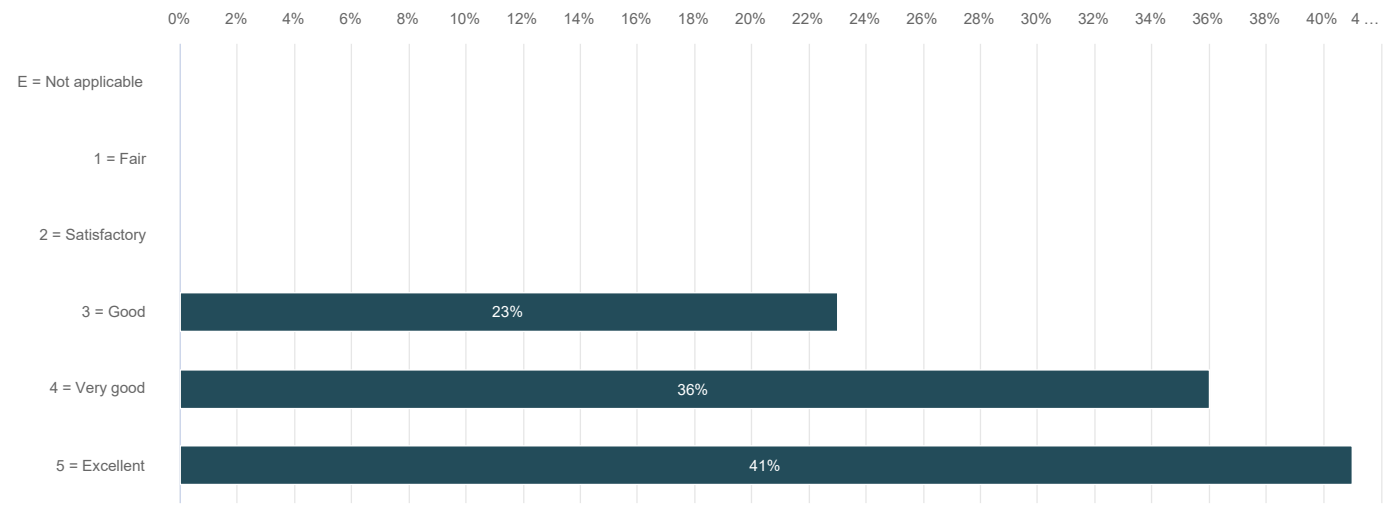
Basic report

CS-E407507 Special course in Machine learning and Data science: Human-centered Machine Learning, Lectures (2022-08-08 - 2022-08-26)

Vastaajien kokonaismäärä: 22

1. My overall assessment of the course

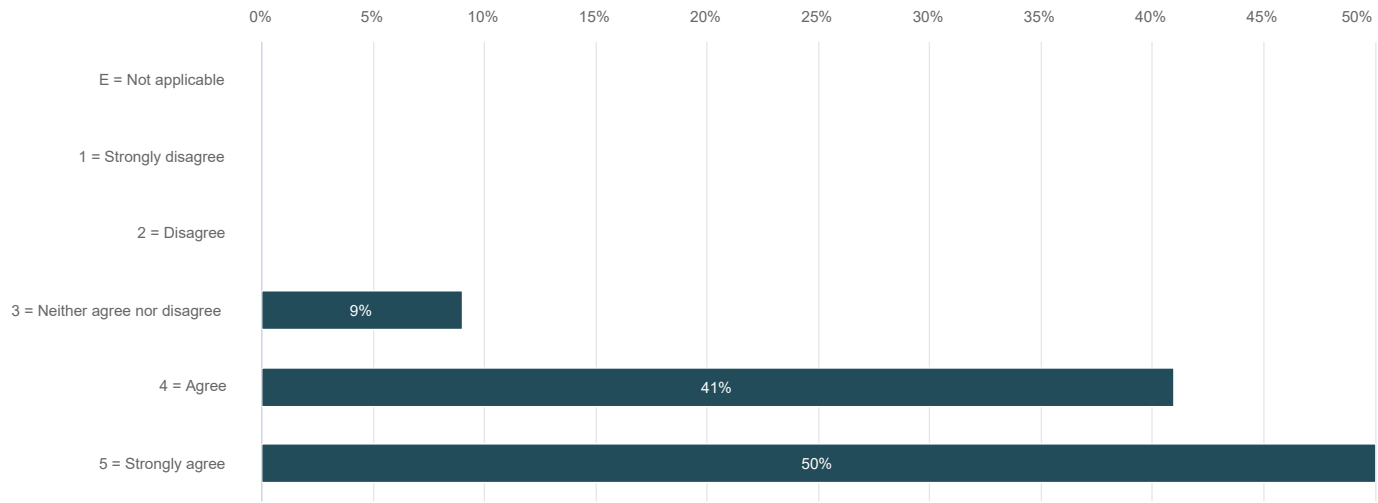
Vastaajien määrä: 22



	n	Prosentti
E = Not applicable	0	0.0%
1 = Fair	0	0.0%
2 = Satisfactory	0	0.0%
3 = Good	5	22.7%
4 = Very good	8	36.4%
5 = Excellent	9	40.9%

2. The teaching methods (lectures, labs, group work, online study, assignments etc.) supported my learning

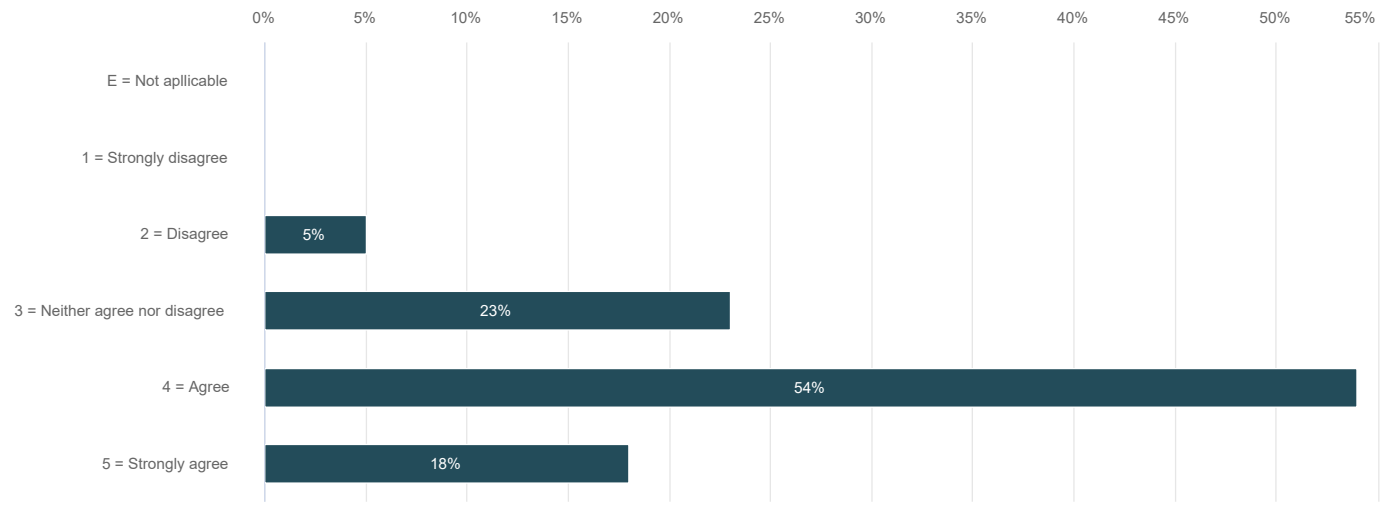
Vastaajien määrä: 22



	n	Prosentti
E = Not applicable	0	0.0%
1 = Strongly disagree	0	0.0%
2 = Disagree	0	0.0%
3 = Neither agree nor disagree	2	9.1%
4 = Agree	9	40.9%
5 = Strongly agree	11	50.0%

3. I am pleased with my study effort on this course

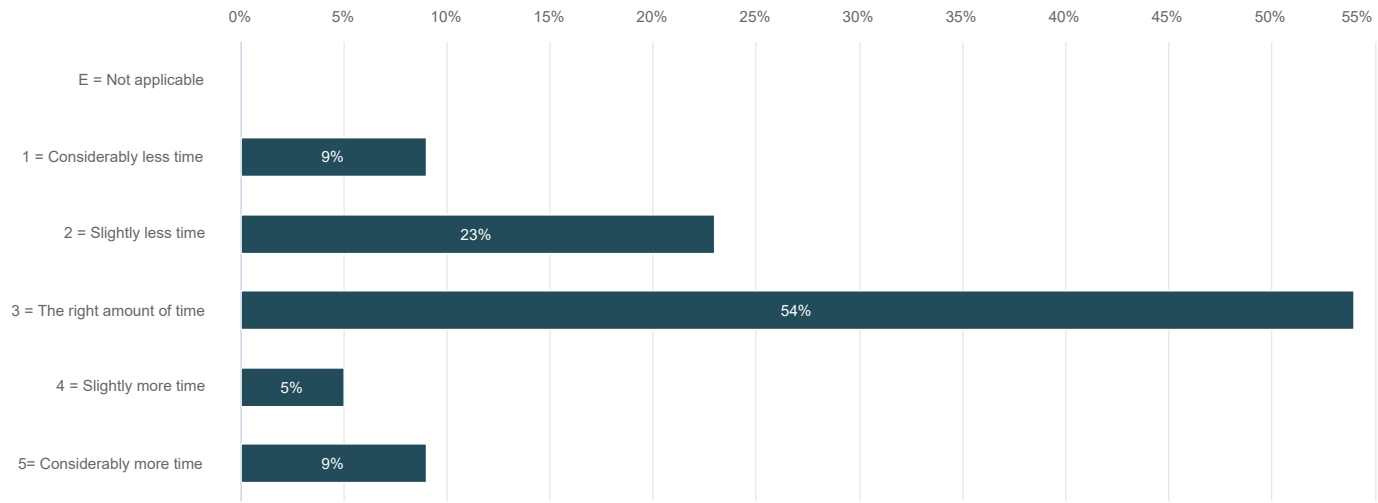
Vastaajien määrä: 22



	n	Prosentti
E = Not apllicable	0	0.0%
1 = Strongly disagree	0	0.0%
2 = Disagree	1	4.6%
3 = Neither agree nor disagree	5	22.7%
4 = Agree	12	54.5%
5 = Strongly agree	4	18.2%

4. According to the guidelines, one credit (ECTS) requires 27 hours of student work. Compared with this, the completion of the course required

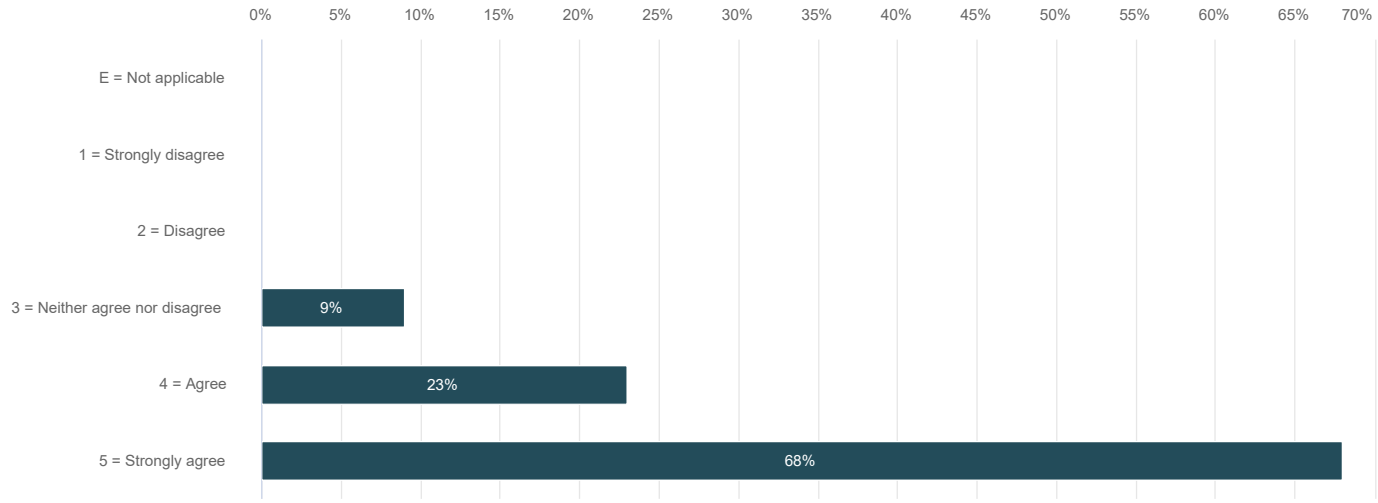
Vastaajien määrä: 22



	n	Prosentti
E = Not applicable	0	0.0%
1 = Considerably less time	2	9.1%
2 = Slightly less time	5	22.7%
3 = The right amount of time	12	54.5%
4 = Slightly more time	1	4.6%
5= Considerably more time	2	9.1%

5. I think I will benefit from the things learnt on the course

Vastaajien määrä: 22



	n	Prosentti
E = Not applicable	0	0.0%
1 = Strongly disagree	0	0.0%
2 = Disagree	0	0.0%
3 = Neither agree nor disagree	2	9.1%
4 = Agree	5	22.7%
5 = Strongly agree	15	68.2%

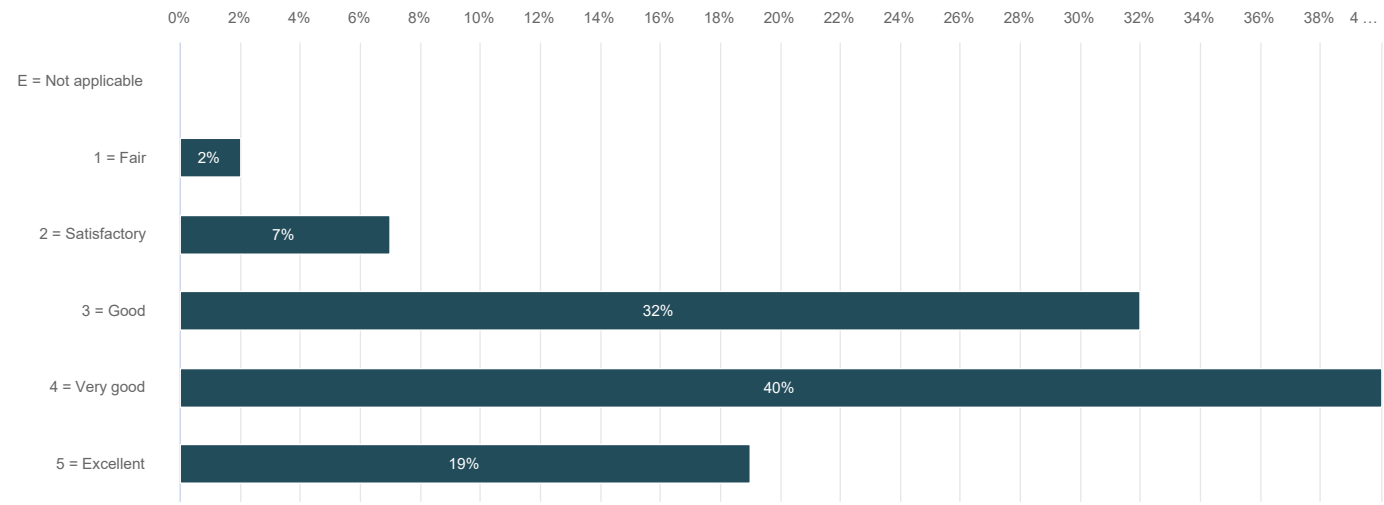
Basic report

CS-C3240 Machine Learning D, Lecture (2022-01-10 - 2022-04-08)

Vastaajien kokonaismäärä: 425

1. My overall assessment of the course

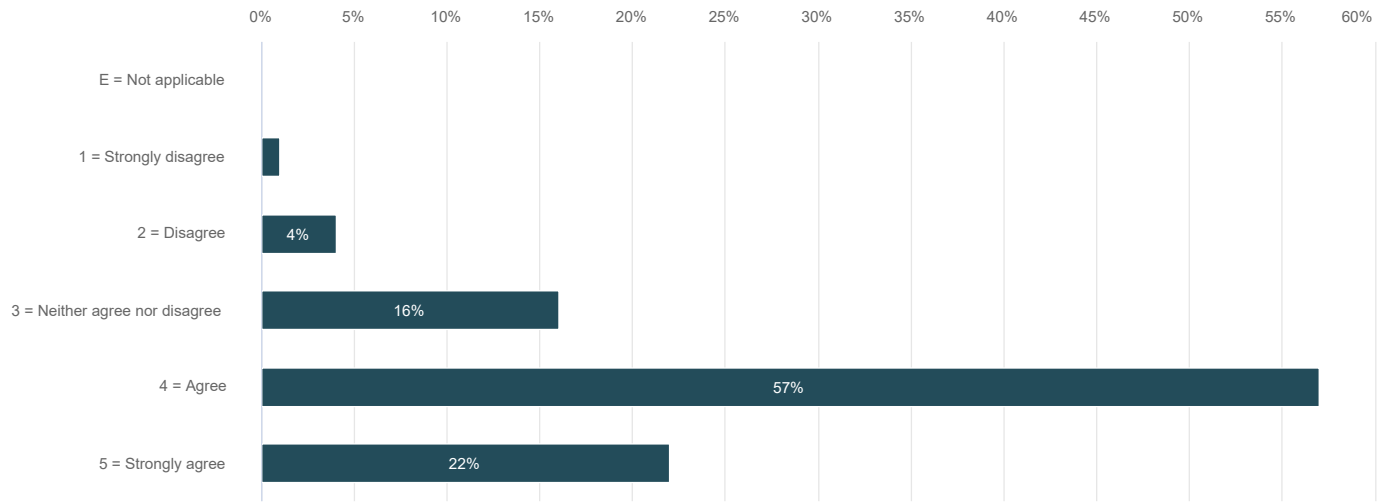
Vastaajien määrä: 425



	n	Prosentti
E = Not applicable	1	0.2%
1 = Fair	11	2.6%
2 = Satisfactory	28	6.6%
3 = Good	137	32.2%
4 = Very good	169	39.8%
5 = Excellent	79	18.6%

2. The teaching methods (lectures, labs, group work, online study, assignments etc.) supported my learning

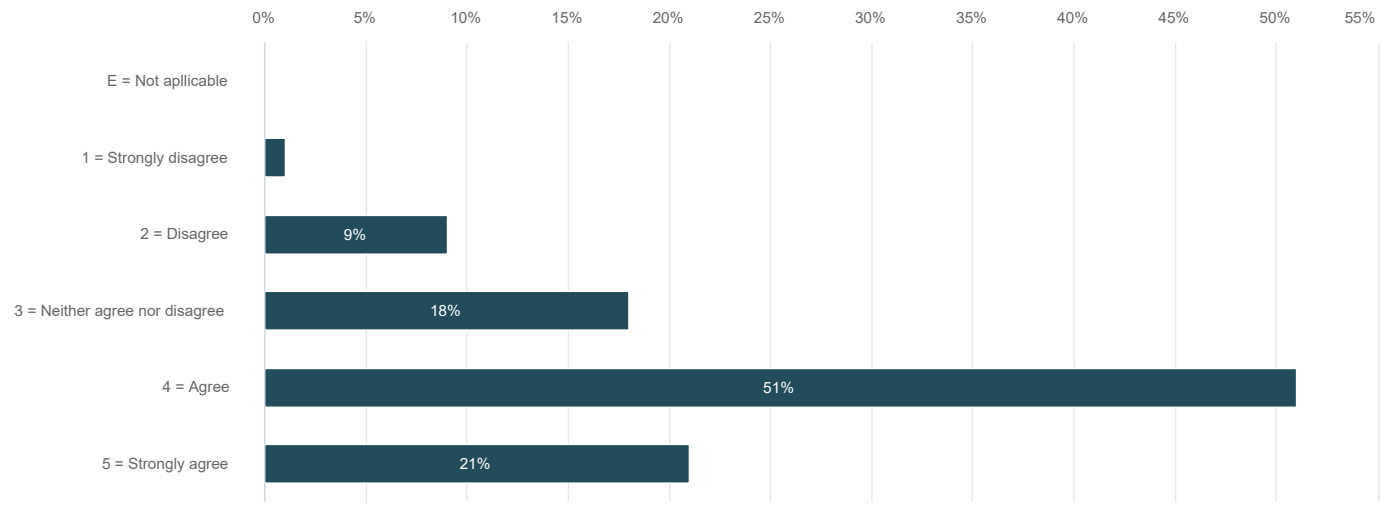
Vastaajien määrä: 425



	n	Prosentti
E = Not applicable	1	0.2%
1 = Strongly disagree	3	0.7%
2 = Disagree	19	4.5%
3 = Neither agree nor disagree	67	15.8%
4 = Agree	243	57.2%
5 = Strongly agree	92	21.6%

3. I am pleased with my study effort on this course

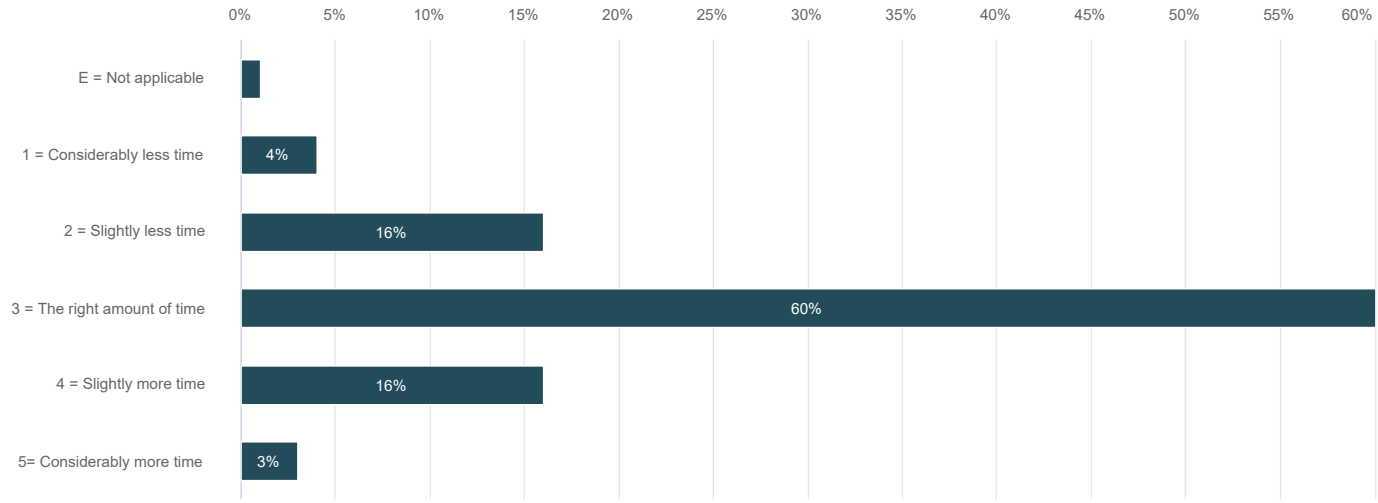
Vastaajien määrä: 425



	n	Prosentti
E = Not apllicable	1	0.2%
1 = Strongly disagree	4	0.9%
2 = Disagree	37	8.7%
3 = Neither agree nor disagree	76	17.9%
4 = Agree	217	51.1%
5 = Strongly agree	90	21.2%

4. According to the guidelines, one credit (ECTS) requires 27 hours of student work. Compared with this, the completion of the course required

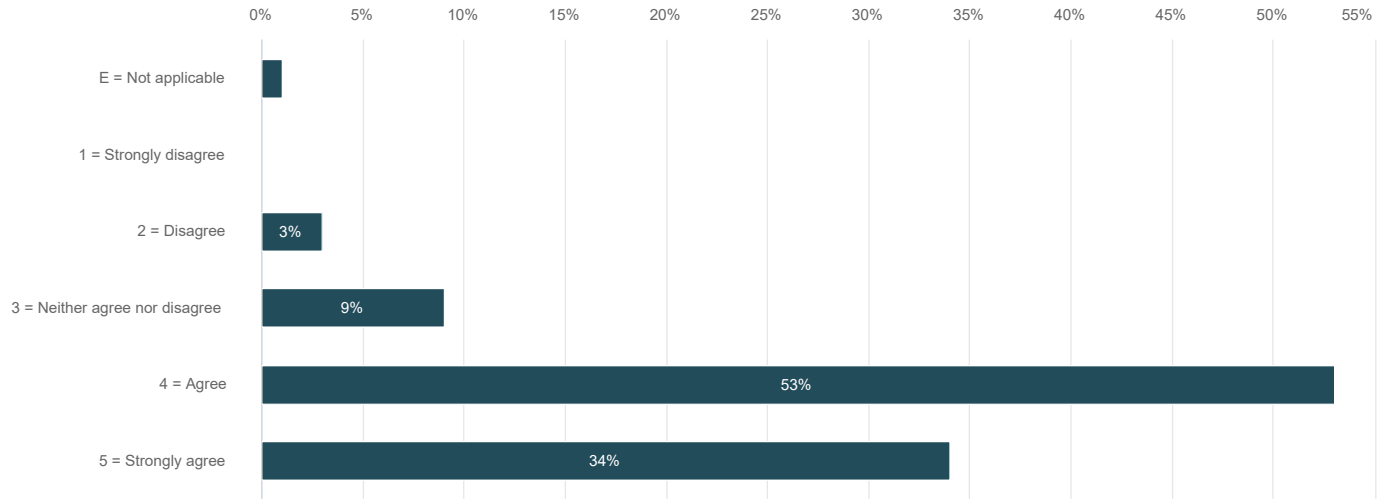
Vastaajien määrä: 425



	n	Prosentti
E = Not applicable	6	1.4%
1 = Considerably less time	18	4.3%
2 = Slightly less time	66	15.5%
3 = The right amount of time	256	60.2%
4 = Slightly more time	66	15.5%
5= Considerably more time	13	3.1%

5. I think I will benefit from the things learnt on the course

Vastaajien määrä: 422



	n	Prosentti
E = Not applicable	5	1.2%
1 = Strongly disagree	2	0.5%
2 = Disagree	12	2.8%
3 = Neither agree nor disagree	37	8.8%
4 = Agree	223	52.8%
5 = Strongly agree	143	33.9%

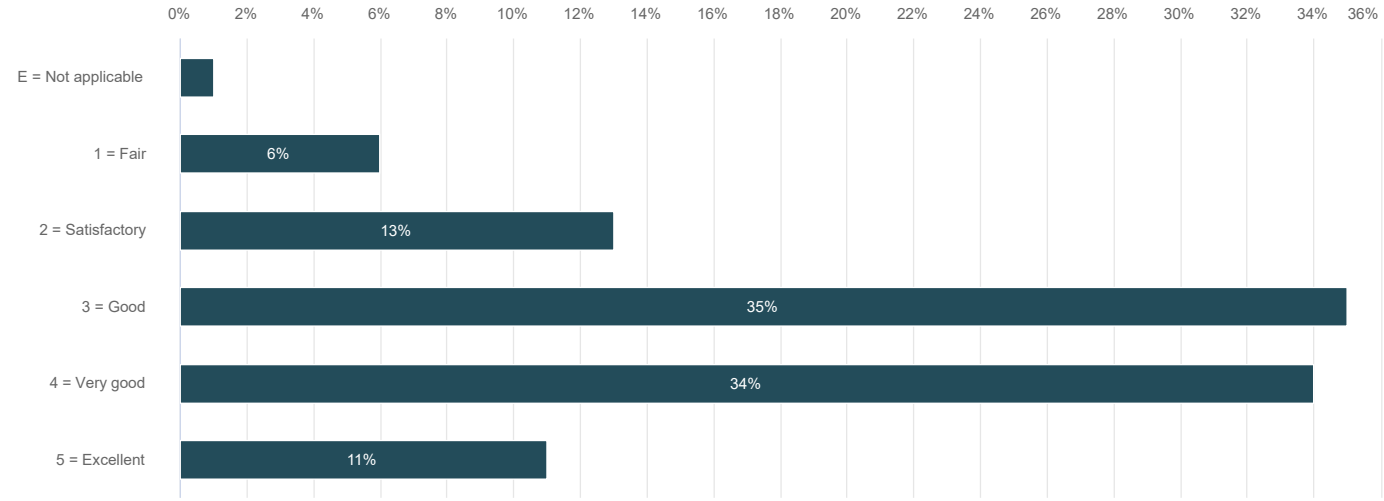
Perusraportti

CS-C3240 Machine Learning D (2021-01-11 - 2021-03-26)

Vastaajien kokonaismäärä: 463

1. My overall assessment of the course

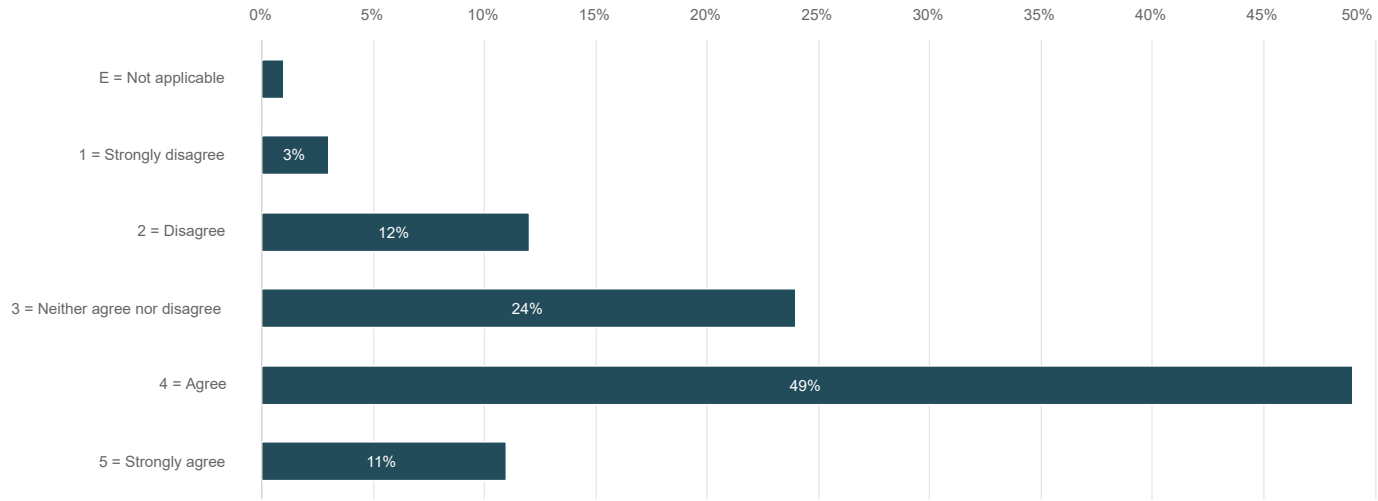
Vastaajien määrä: 463



	n	Prosentti
E = Not applicable	4	0.9%
1 = Fair	28	6.0%
2 = Satisfactory	62	13.4%
3 = Good	162	35.0%
4 = Very good	155	33.5%
5 = Excellent	52	11.2%

2. The teaching methods (lectures, labs, group work, online study, assignments etc.) supported my learning

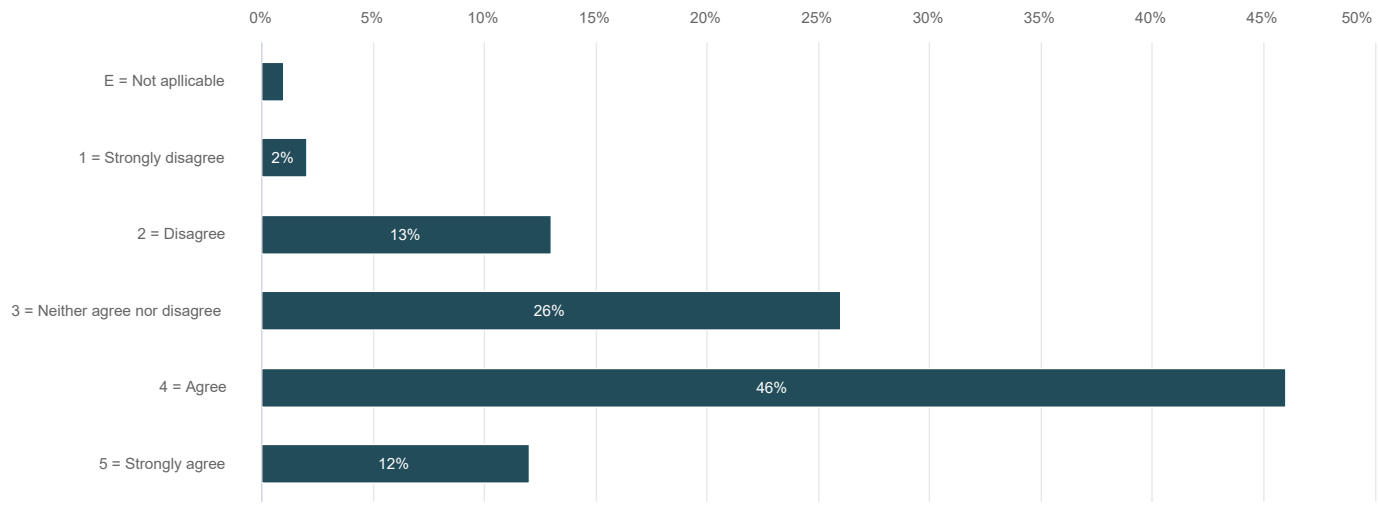
Vastaajien määrä: 463



	n	Prosentti
E = Not applicable	4	0.9%
1 = Strongly disagree	16	3.5%
2 = Disagree	55	11.9%
3 = Neither agree nor disagree	109	23.5%
4 = Agree	227	49.0%
5 = Strongly agree	52	11.2%

3. I am pleased with my study effort on this course

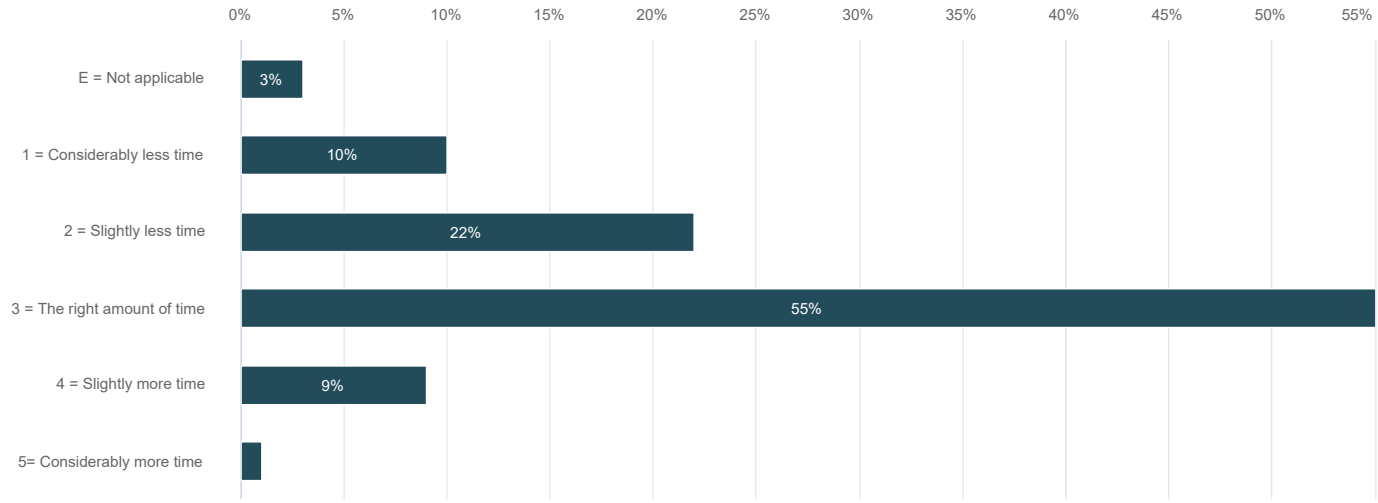
Vastaajien määrä: 463



	n	Prosentti
E = Not apllicable	2	0.4%
1 = Strongly disagree	11	2.4%
2 = Disagree	62	13.4%
3 = Neither agree nor disagree	122	26.4%
4 = Agree	213	46.0%
5 = Strongly agree	53	11.4%

4. According to the guidelines, one credit (ECTS) requires 27 hours of student work. Compared with this, the completion of the course required

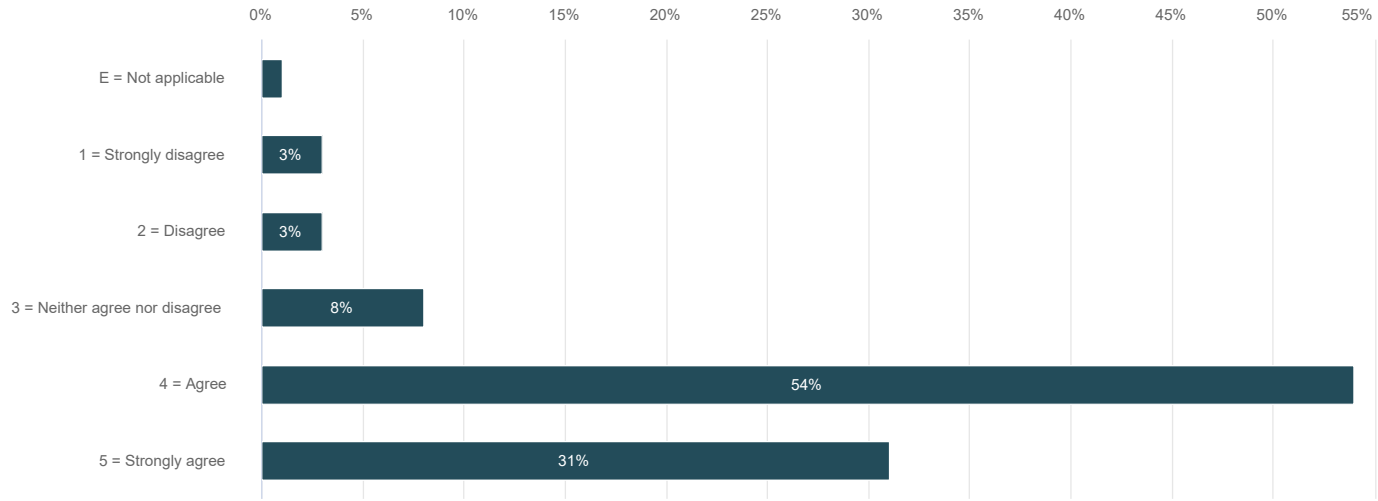
Vastaajien määrä: 463



	n	Prosentti
E = Not applicable	12	2.6%
1 = Considerably less time	48	10.4%
2 = Slightly less time	100	21.6%
3 = The right amount of time	255	55.1%
4 = Slightly more time	41	8.8%
5= Considerably more time	7	1.5%

5. I think I will benefit from the things learnt on the course

Vastaajien määrä: 463



	n	Prosentti
E = Not applicable	5	1.1%
1 = Strongly disagree	12	2.6%
2 = Disagree	13	2.8%
3 = Neither agree nor disagree	38	8.2%
4 = Agree	249	53.8%
5 = Strongly agree	146	31.5%

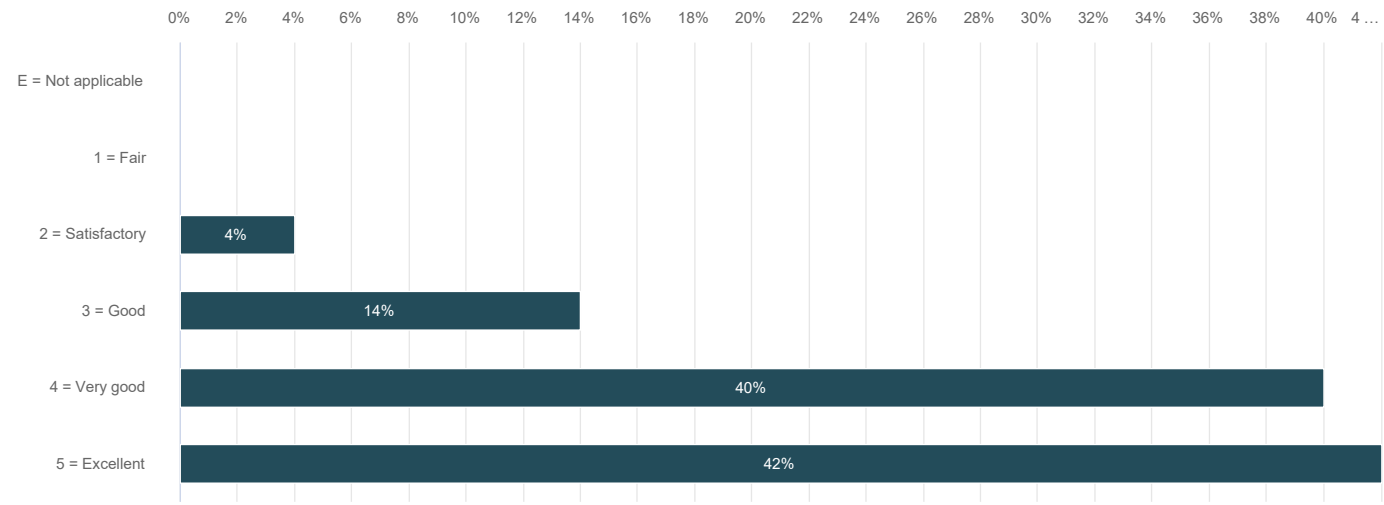
Basic report

CS-EJ3211 Machine Learning with Python D, Lectures (2022-01-10 - 2022-04-08)

Vastaajien kokonaismäärä: 55

1. My overall assessment of the course

Vastaajien määrä: 55



	n	Prosentti
E = Not applicable	0	0.0%
1 = Fair	0	0.0%
2 = Satisfactory	2	3.6%
3 = Good	8	14.6%
4 = Very good	22	40.0%
5 = Excellent	23	41.8%

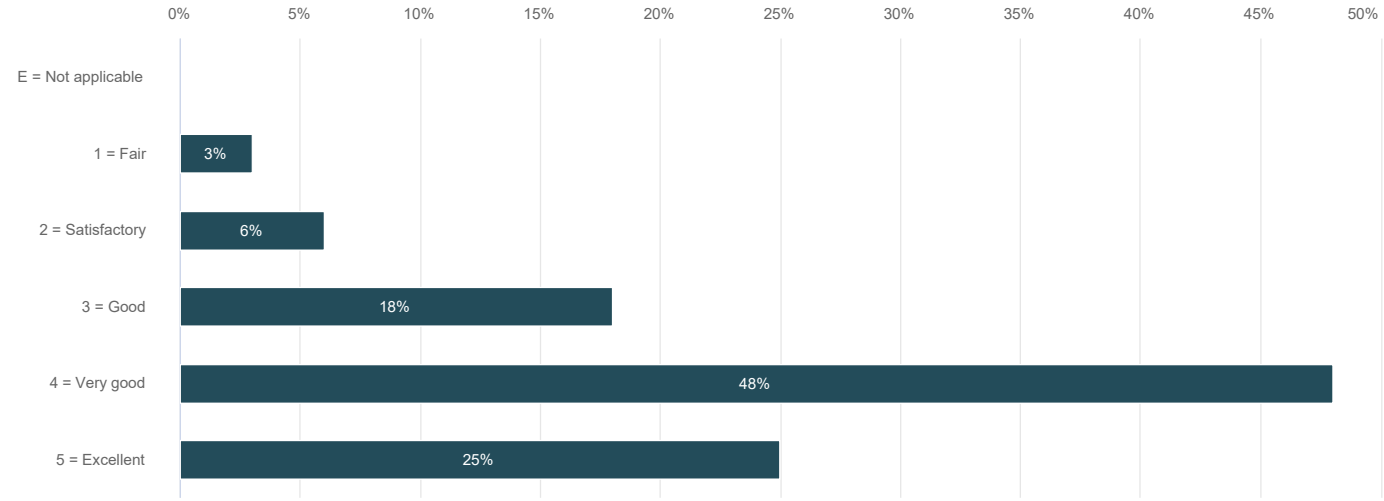
Basic report

CS-EJ3211 Machine Learning with Python D (2021-01-11 - 2021-03-26)

Vastaajien kokonaismäärä: 65

1. My overall assessment of the course

Vastaajien määrä: 65



	n	Prosentti
E = Not applicable	0	0.0%
1 = Fair	2	3.1%
2 = Satisfactory	4	6.1%
3 = Good	12	18.5%
4 = Very good	31	47.7%
5 = Excellent	16	24.6%

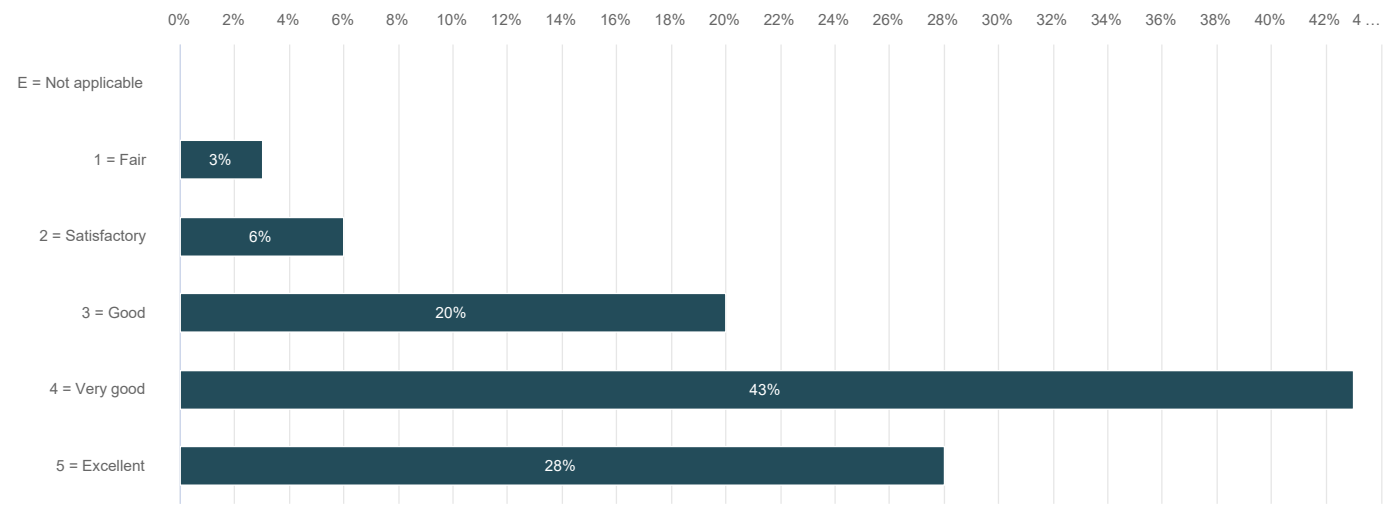
Basic report

CS-EJ3211 Machine Learning with Python D (2021-03-29 - 2021-06-04)

Vastaajien kokonaismäärä: 35

1. My overall assessment of the course

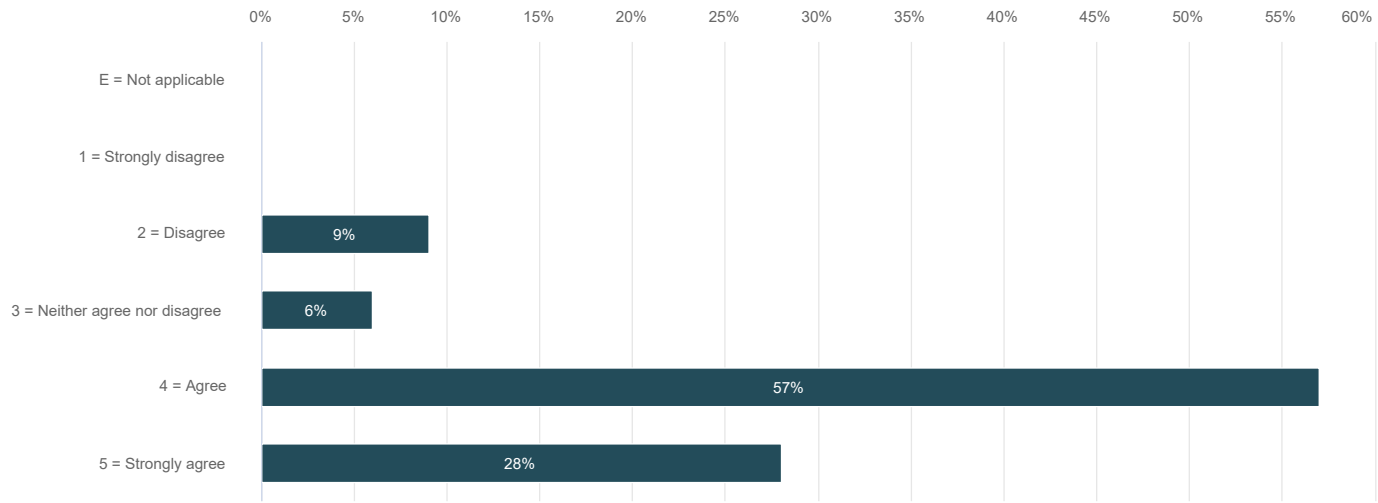
Vastaajien määrä: 35



	n	Prosentti
E = Not applicable	0	0.0%
1 = Fair	1	2.9%
2 = Satisfactory	2	5.7%
3 = Good	7	20.0%
4 = Very good	15	42.8%
5 = Excellent	10	28.6%

2. The teaching methods (lectures, labs, group work, online study, assignments etc.) supported my learning

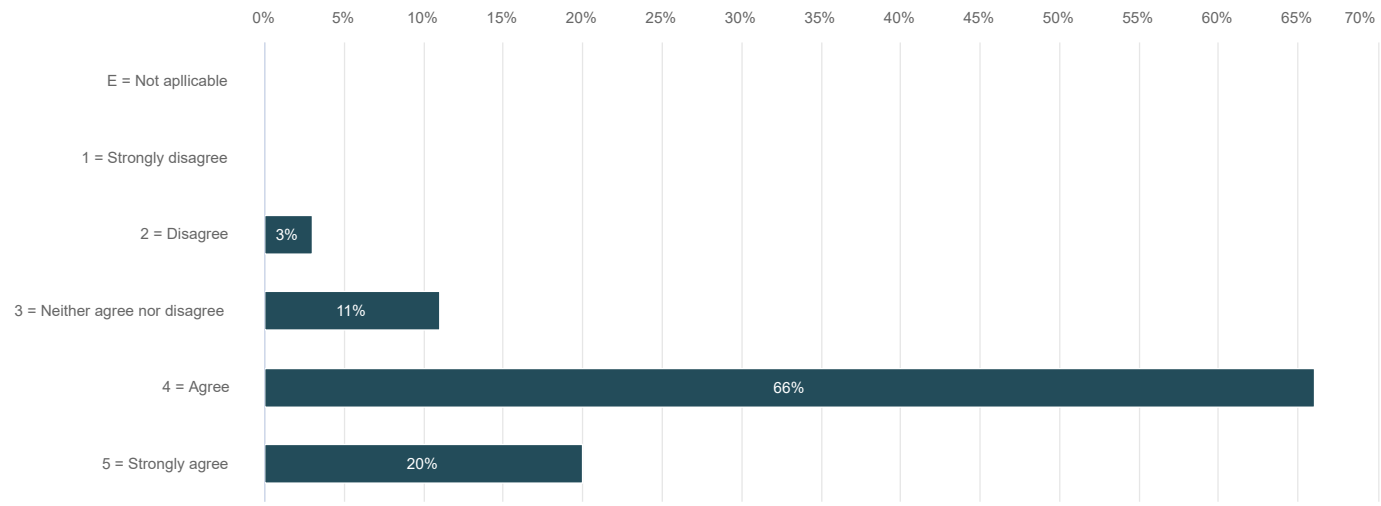
Vastaajien määrä: 35



	n	Prosentti
E = Not applicable	0	0.0%
1 = Strongly disagree	0	0.0%
2 = Disagree	3	8.6%
3 = Neither agree nor disagree	2	5.7%
4 = Agree	20	57.1%
5 = Strongly agree	10	28.6%

3. I am pleased with my study effort on this course

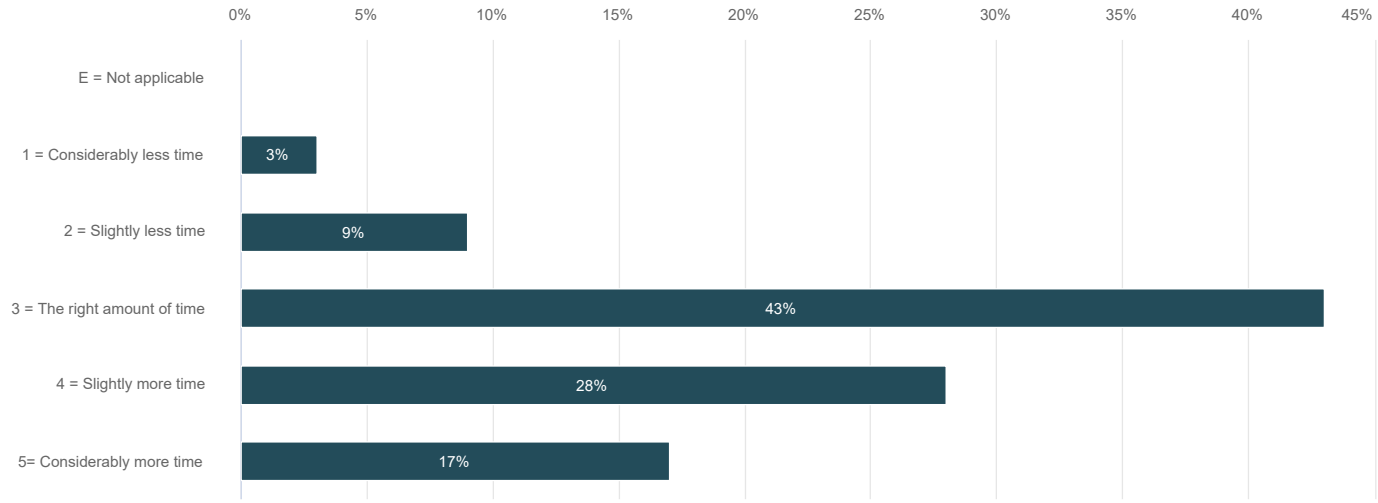
Vastaajien määrä: 35



	n	Prosentti
E = Not apllicable	0	0.0%
1 = Strongly disagree	0	0.0%
2 = Disagree	1	2.9%
3 = Neither agree nor disagree	4	11.4%
4 = Agree	23	65.7%
5 = Strongly agree	7	20.0%

4. According to the guidelines, one credit (ECTS) requires 27 hours of student work. Compared with this, the completion of the course required

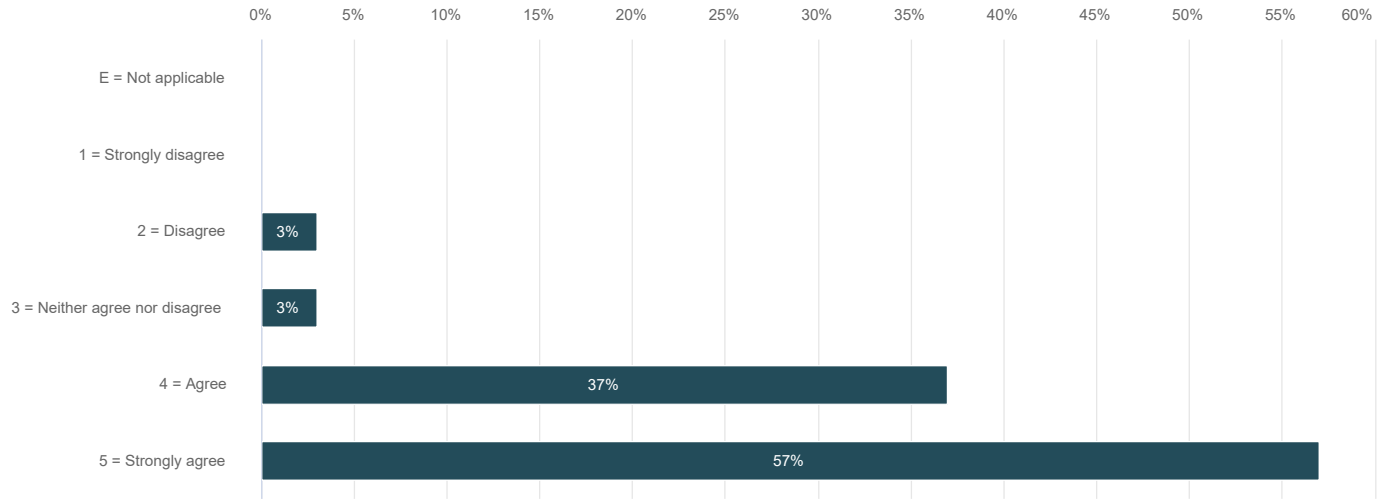
Vastaajien määrä: 35



	n	Prosentti
E = Not applicable	0	0.0%
1 = Considerably less time	1	2.9%
2 = Slightly less time	3	8.6%
3 = The right amount of time	15	42.8%
4 = Slightly more time	10	28.6%
5= Considerably more time	6	17.1%

5. I think I will benefit from the things learnt on the course

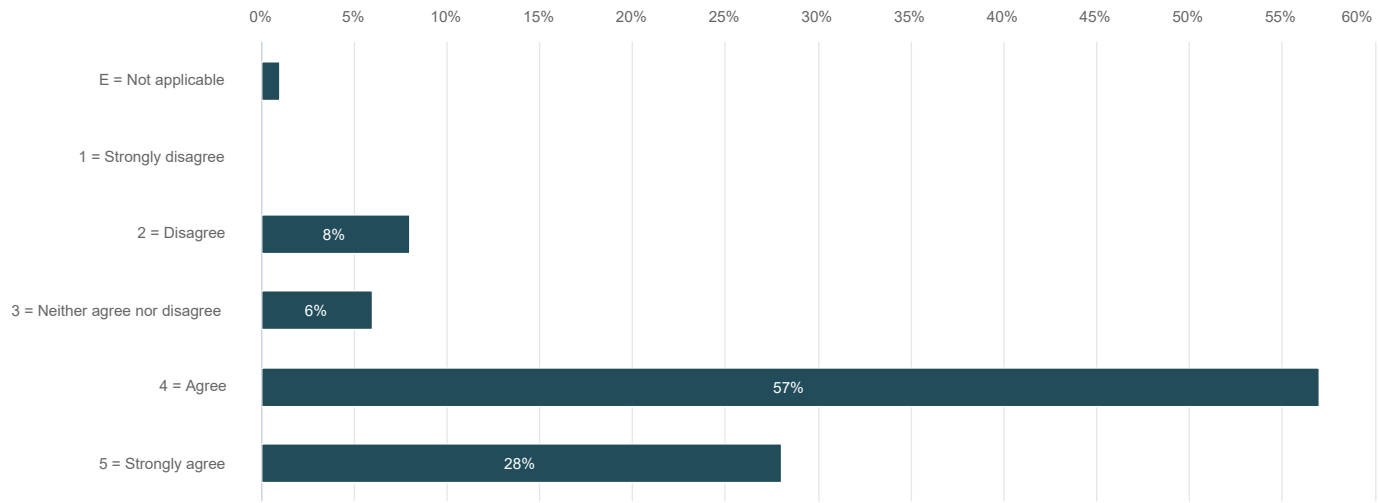
Vastaajien määrä: 35



	n	Prosentti
E = Not applicable	0	0.0%
1 = Strongly disagree	0	0.0%
2 = Disagree	1	2.9%
3 = Neither agree nor disagree	1	2.9%
4 = Agree	13	37.1%
5 = Strongly agree	20	57.1%

2. The teaching methods (lectures, labs, group work, online study, assignments etc.) supported my learning

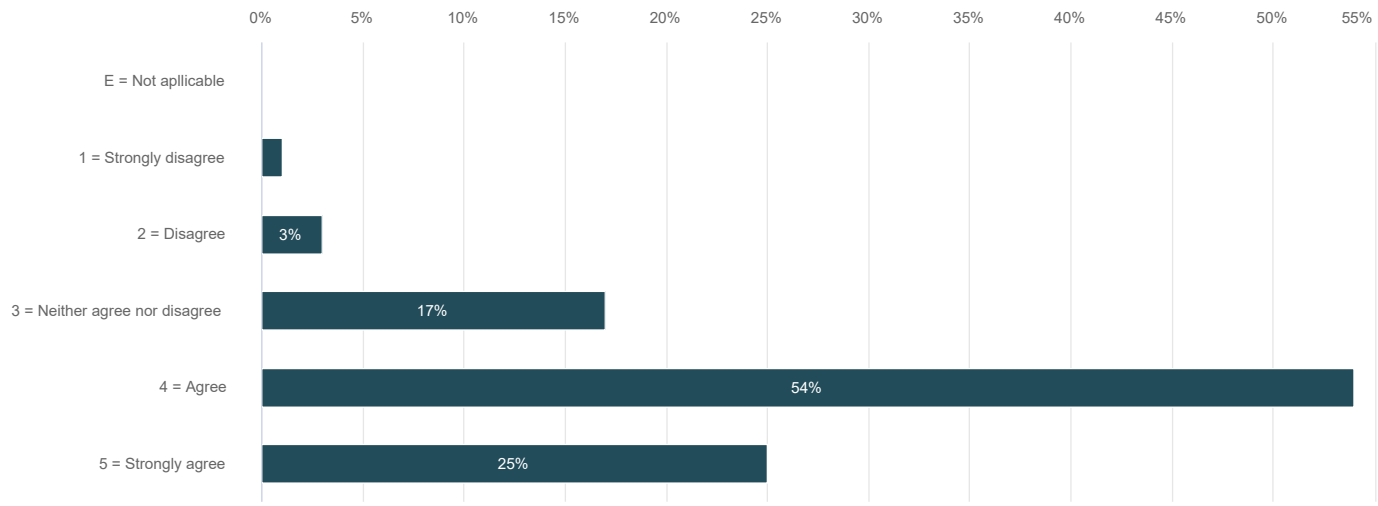
Vastaajien määrä: 65



	n	Prosentti
E = Not applicable	1	1.5%
1 = Strongly disagree	0	0.0%
2 = Disagree	5	7.7%
3 = Neither agree nor disagree	4	6.2%
4 = Agree	37	56.9%
5 = Strongly agree	18	27.7%

3. I am pleased with my study effort on this course

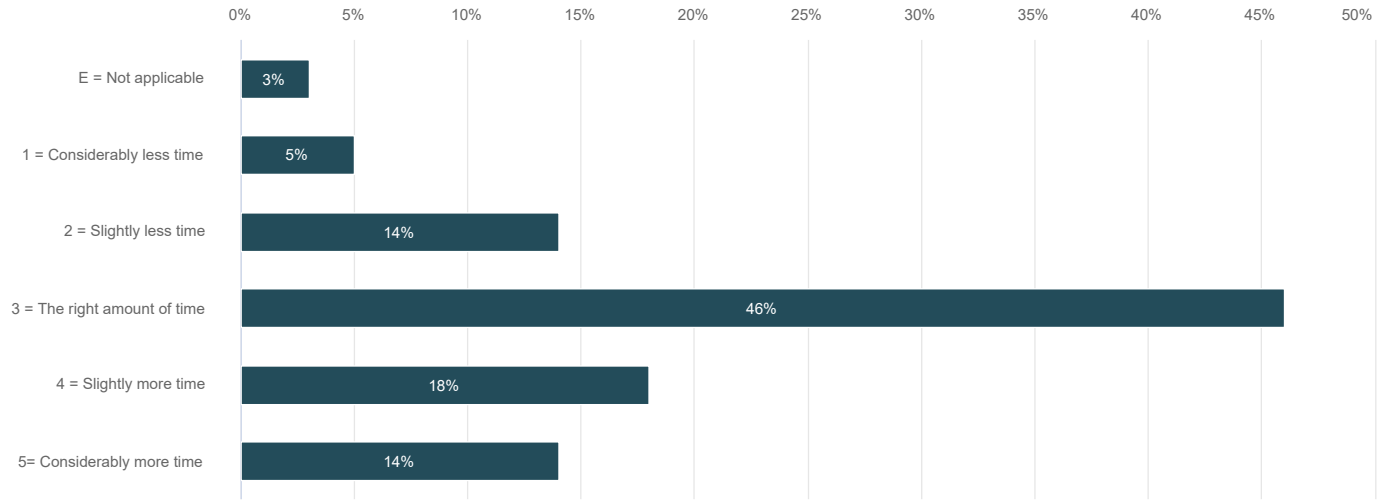
Vastaajien määrä: 65



	n	Prosentti
E = Not apllicable	0	0.0%
1 = Strongly disagree	1	1.5%
2 = Disagree	2	3.1%
3 = Neither agree nor disagree	11	16.9%
4 = Agree	35	53.9%
5 = Strongly agree	16	24.6%

4. According to the guidelines, one credit (ECTS) requires 27 hours of student work. Compared with this, the completion of the course required

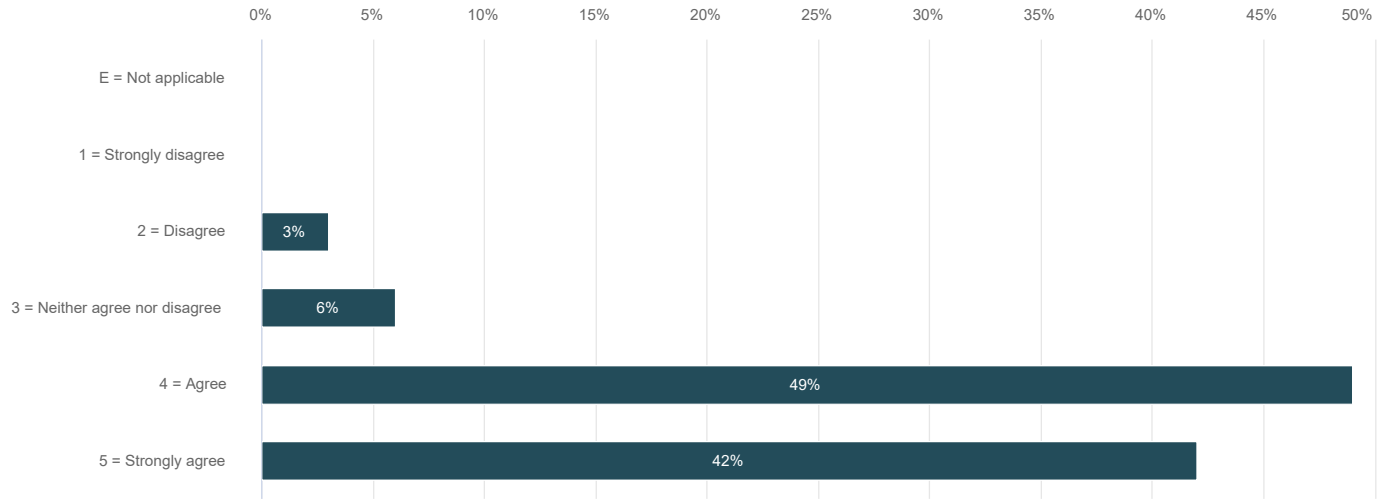
Vastaajien määrä: 65



	n	Prosentti
E = Not applicable	2	3.1%
1 = Considerably less time	3	4.6%
2 = Slightly less time	9	13.8%
3 = The right amount of time	30	46.2%
4 = Slightly more time	12	18.5%
5= Considerably more time	9	13.8%

5. I think I will benefit from the things learnt on the course

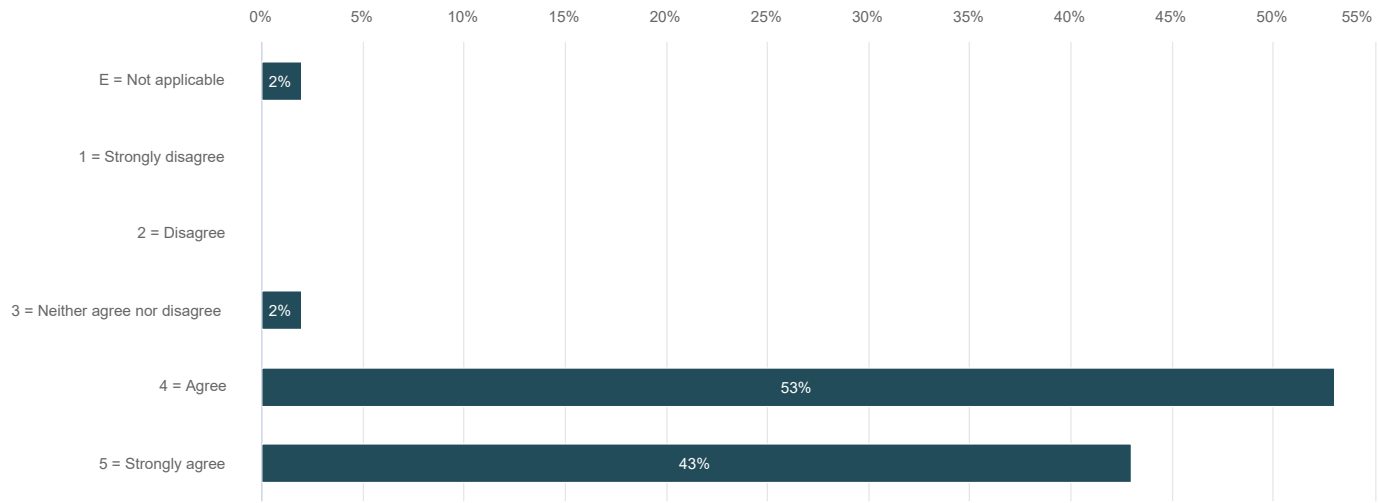
Vastaajien määrä: 65



	n	Prosentti
E = Not applicable	0	0.0%
1 = Strongly disagree	0	0.0%
2 = Disagree	2	3.1%
3 = Neither agree nor disagree	4	6.2%
4 = Agree	32	49.2%
5 = Strongly agree	27	41.5%

2. The teaching methods (lectures, labs, group work, online study, assignments etc.) supported my learning

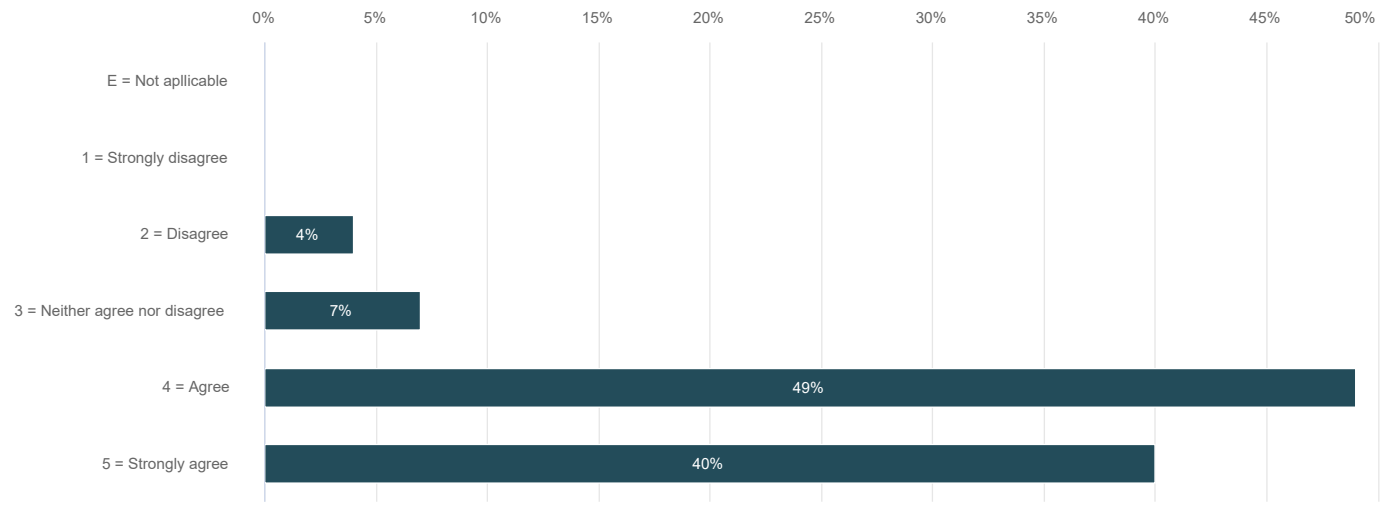
Vastaajien määrä: 55



	n	Prosentti
E = Not applicable	1	1.8%
1 = Strongly disagree	0	0.0%
2 = Disagree	0	0.0%
3 = Neither agree nor disagree	1	1.8%
4 = Agree	29	52.7%
5 = Strongly agree	24	43.7%

3. I am pleased with my study effort on this course

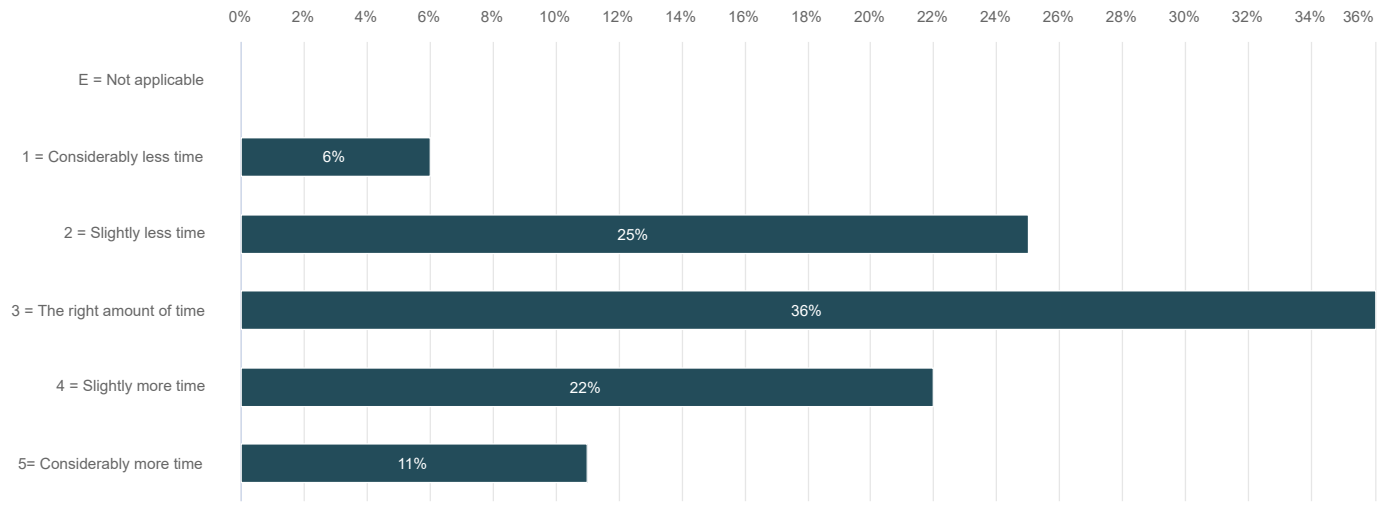
Vastaajien määrä: 55



	n	Prosentti
E = Not apllicable	0	0.0%
1 = Strongly disagree	0	0.0%
2 = Disagree	2	3.6%
3 = Neither agree nor disagree	4	7.3%
4 = Agree	27	49.1%
5 = Strongly agree	22	40.0%

4. According to the guidelines, one credit (ECTS) requires 27 hours of student work. Compared with this, the completion of the course required

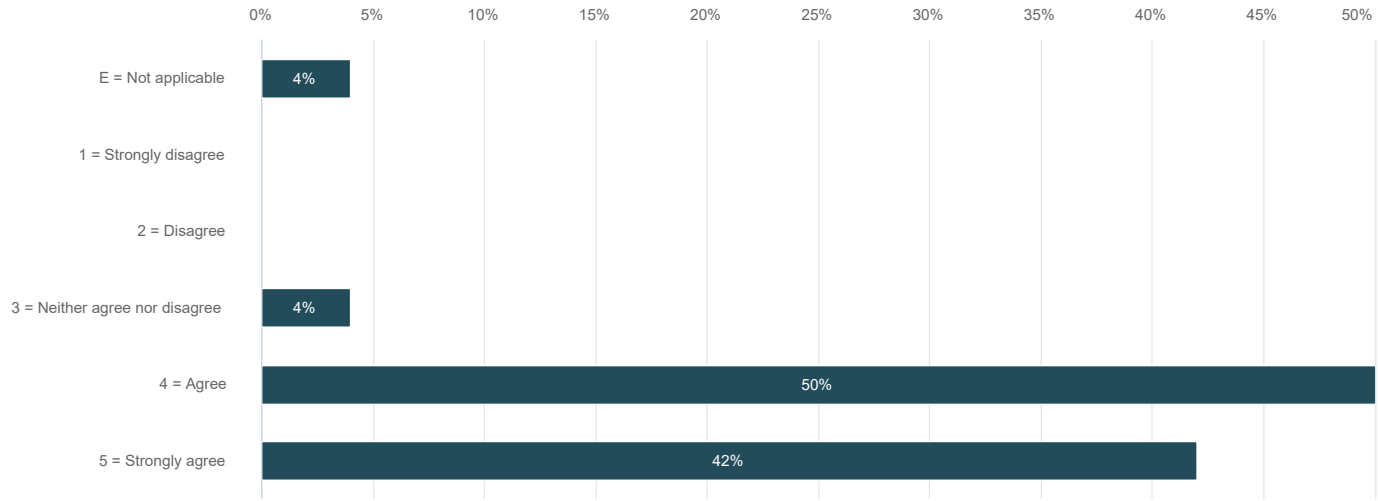
Vastaajien määrä: 55



	n	Prosentti
E = Not applicable	0	0.0%
1 = Considerably less time	3	5.5%
2 = Slightly less time	14	25.4%
3 = The right amount of time	20	36.4%
4 = Slightly more time	12	21.8%
5= Considerably more time	6	10.9%

5. I think I will benefit from the things learnt on the course

Vastaajien määrä: 54



	n	Prosentti
E = Not applicable	2	3.7%
1 = Strongly disagree	0	0.0%
2 = Disagree	0	0.0%
3 = Neither agree nor disagree	2	3.7%
4 = Agree	27	50.0%
5 = Strongly agree	23	42.6%

APPENDIX C
RESPONSE LETTERS FOR STUDENT FEEDBACK

Response to Student Feedback received for the course CS-EJ3211 - "Machine Learning with Python" offered during May - July 2020 at Aalto University and within FiTech https://fitech.io/en/

Teacher: Assistant Professor Alexander Jung

Teaching Assistants:Shamsiiat Abdurakhmanova, Mikko Salervo and Ivan Baranov

(first.last (at) aalto.fi)

August 16, 2020

We express our sincere gratitude for the constructive comments and suggestions provided by the students of the course CS-EJ3211 "Machine Learning with Python" as offered during summer 2020. We have tried to address all comments to the extent possible. Major modifications we implemented include the following:

- We now try to make the attendance of online lectures more attractive to students. These lectures allow for asking and discussing questions of students. ??? offer bonus points for constructive and relevant contributions to discussion during online lecture ??? However, we still make recordings of all lectures and talks available throughout the course.
- We will now use MyCourse quizzes to grade the coding assignments. These quizzes consist of multiple choice questions which should be answered with the support of the Python notebooks. Using MyCourse quizzes has the advantage of allowing for immediate feedback to student submissions.
- We have revised the course schedule with having the six rounds as a bootcamp during the first half of the course, and the second half focusing on the student projects.
- We will now use peer grading of student project reports to facilitate student-student interaction.
- We will award bonus points for constructive contributions to the course discussion forum ("Slack"). We hope that offering these bonus points will support the student-student interaction.

In what follows, we respond in a point-by-point fashion to selected student feedbacks received for the "2020 summer" course edition during the official feedback survey carried out for courses at Aalto university. The student feedbacks are enumerated as S1,S2,... and the corresponding response as R1,R2,....

S1 *Some of the task descriptions were phrased in an unclear way.*

R1 We have revised the notebooks carefully to avoid any misunderstandings.

S2 *Lectures can explain more about programming part*

R2 We will now make more references to the Python notebooks during the lectures.

S3 *The schedule of the course could have been better informed, such as when does each of the round start and when are their deadlines.*

R3 We will announce the schedule well before the course starts via the MyCourses page mlwithpython.cs.aalto.fi

S4 *More examples would be useful*

R4 We plan to use peer grading for the student project reports. During the peer grading, students learn about the machine learning problems considered by other students.

S5 *On-the-fly feedback on the assignments: not only "sanity checks".*

R5 We plan to use MyCourses quizzes to replace the auto-graded student tasks in the Python notebooks. These MyCourses quizzes provide immediate feedback to student submissions.

S6 *Lecture times could be announced a bit earlier*

R6 We will try to be more timely and clear in the announcement of lecture times.

S7 *Lecture times could be announced a bit earlier*

R7 We have now created a dedicated Section on the Mycourses page (mlwithpython.cs.aalto.fi) entitled "Lectures and Talks" which lists the times of lectures and talks. We will try out best to finalize this list before the course starts.

S8 *The grading is quite easy for students and does not at itself encourage to do the obligatory projects, as the project topics were quite challenging. Could be better if the project was a semi-mandatory part of course but a bit easier and smaller in scale.*

R8 The student projects are not meant as obligatory but rather as another task that can be used to earn points. However, we will adapt the course schedule (bootcamp during first period and then plenty of time for project) to make student projects more attractive. Moreover, we will provide more examples for student projects.

S9 *I think I also lacked more content on the lectures which would tie homework with theory. Most of the time I felt that theory is too high-level and assignments are too specific. This gap needs to be bridged with some demo sessions or seminars where theory for topic X is joined with some practice before doing the assignments.*

R9 We will try to have more references to the coding assignments during the lectures. In particular, we plan to walk through parts of the notebooks during the lectures.

S10 *It might be my preference only, but it would have helped me a lot more to have the tasks in a notebook and the learning material for the specific round in a PDF or some downloadable format. When I wanted to revisit a topic while working on the tasks, it was difficult to scroll and find the material or to have to reopen a previous notebook and scroll to find some information I wanted to revisit. I believe it would have helped me out a lot to have the tasks and learning material in separate files.*

R10 We will now provide pdf printouts of the Jupyter notebooks for students convenience. These printouts can be found at the MyCourse page under Section ????

S11 *Some of the bonus task have a too high score.*

R11 We will adjust the maximum number of points awarded for the bonus tasks.

S12 *The notebook have sometime part that are too adavced for the course.*

R12 We have adjusted the amount of background information (e.g., interpretations of certain parameters) provided in the notebooks. Moreover, we now provide more pointers to background reading (beyond the scope of the course).

Response to Student Feedback received for the course CS-EJ3311 "Deep Learning with Python" offered during fall 2020 at Aalto University and via FiTech https://fitech.io/en/

corresponding teacher: Alex Jung (first.last (at) aalto.fi)

September 3, 2021

We express our sincere gratitude for the insightful and constructive comments and suggestions provided by the students of the course **CS-EJ3311 "Deep Learning with Python"** offered during fall 2020. We try to address (most of) the comments with the design of the new course edition in fall 2021. Some major modifications are:

- We have slightly reorganized the course structure which is now given as
  - Round 0: Components of Machine Learning.
  - Round 1: Artificial Neural Networks.
  - Round 2: Gradient-Based Learning.
  - Round 3: Convolutional Neural Networks.
  - Round 4: Regularization.
  - Round 5: Natural Language Processing.
  - Round 6: Generative Adversarial Networks.
- The new course will include lecture sessions that provide background for and motivate the techniques covered in the notebooks.
- The Python notebooks now include student tasks that require small coding assignments.
- There will be no student project in the new course edition.
- We will randomly choose students at the end of the course who have to explain in detail their solutions to the coding assignments.

In what follows, we respond in a point-by-point fashion to a selection of the most relevant student feedback received for the "2020 Fall" edition of the course CS-EJ3311 "Deep Learning with Python".

S1 *Assignments:could require some own coding. maybe there could be some small part in each assingnment that is not ready made, but clearly explained what to do.*

A1 The main course material for the new course edition will again be in the form of Python notebooks. In contrast to the previous course edition, the notebooks now include small coding assignments (or student tasks). The student solutions to this coding assignments will be graded automatically as soon as the student submits her notebook to the JupyterHub server at https://jupyter.cs.aalto.fi/.

S2 *Some questions in the quizzes were a bit confusing, but after all the information about correct answers was available somehow (e.g. from slack).*

A2 We have carefully revised the quiz questions which are now included towards the end of the Python notebooks.

S3 *I think it would be great to upload all lectures to Youtube, with password or something if not otherwise possible.*

A3 We will make the recordings of lectures available via my YouTube channel https://www.youtube.com/channel/UC_tW4Z_GfJ2WCnKDtwMuDUA.

S4 *maybe including more modules about different types of DL algorithms*

A4 We are not sure what is meant here by "DL algorithms". Round 2 discusses gradient descent (and some of its variants) as maybe the most widely used method for training deep nets. We have also extended the rounds by including deep learning methods for natural language processing (Round 5) and data synthesizing (Round 6 on generative adversarial networks).

S5 *The grading system for example i completed the Quiz 1 but I can not see the grade or I got zero because i did not submit the feedback.*

A5 We now grade the student solutions automatically as soon as the student submits her notebook via the JupyterHub server at https://jupyter.cs.aalto.fi/. Using the JupyterHub server should ensure that students get feedback more timely (within few days).

S6 *The course required no programming at all. It should have at least some programming tasks, like in ML with Python. It was now a too easy pass by just looking at materials and answering quizzes.*

A6 see our response A1.

S7 *The topics didnt go in to the theory that much.*

A7 The new course edition includes some lectures on the theoretical underpinnings of the deep learning methods covered in this course. However, the main focus of this introductory course is to build useful intuition for the behaviour of deep learning methods and their implementation using the Python library Keras (https://keras.io/). For a more in-depth treatment of the mathematical principles of deep learning, we refer to more advanced courses such as CS-E4710-*Machine Learning: Supervised Methods* or CS-E4890-*Deep Learning*.

S8 *It was a disappointment we did not actually write any code. The previous course Machine Learning with Python has been incredibly useful for me because I learned Python and have used it a lot since. This course on Deep learning was more of a nice to know..*

A8 The format of new course edition of CS-EJ3311 Deep Learning with Python will be more similar to the format of CS-EJ3211 Machine Learning with Python. In particular it will also use notebooks with coding assignments ("student tasks"). After completing the coding assignments, students submit their notebooks to https://jupyter.cs.aalto.fi. See also our response A1.

S10 *Towards the end of the course I also felt we were running out of content. It would have been great to learn a bit also about how to handle data sets that include text.*

A10 The new course edition now includes Round 5 on natural language processing. This round will discuss deep learning methods for text data. For more details on natural language processing methods, we refer to the advanced courses CS-E4890-*Deep Learning* and ELEC-E5510-*Speech Recognition* (you can think of speech as text in audio form).

S11 *Some type of QnA session where people ask what type of approach is a good candidate for a given problem might be good (I know one could do this via slack but very few did). Also I though some kind of pair programming in projects or peer mentoring could be good. There was not too much interaction between students. I personally had questions like why is my model currently getting abysmal results - is it the data, the approach or do I just have simple code errors that I cannot see that might have benefited from a pair of extra eyes.*

A11 That is a good point. We will encourage students to make good use of the course discussion forum. A main purpose of this forum is to allow for uncomplicated interaction between students.

S12 *It would be nice to have some basics of deep learning at the start. Especially developing a simple deep learning model from scratch without use of deep learning libraries.*

A12 The new course edition now includes a recap of the basic principles and components used by deep learning methods (see Round 0). We have also revised the notebook for Round 1 ("Artificial Neural Networks") such that it includes for details on the building blocks of artificial neural networks. For more details on the implementation (starting from low-level libraries for matrix computations) of deep learning algorithms, we refer to the more advanced course CS-E4890-*Deep Learning*.

S13 *There were some typos/mistakes in the notebooks but I believe those were fixed. This course could have even more examples of different methods. Now this felt little too short.*

A13 We have carefully revised the notebooks and tried to improve the use of language and clarity of presentation. These notebooks now also include coding assignments that should enforce a deeper understanding of the discussed methods. In the new course edition, we now also discuss deep learning methods for classifying text data (Round 5- NLP) and for synthesizing data (Round 6 - GAN).

S14 *I would suggest more concentration on the selection of the Optimisers, more wide focusing on the interpretation of the trained model performance, how to make the model to learn the ordinal variables (ordinal classification).*

A14 We have now expanded the discussion of optimizers in the Round 2 of the new course edition. More details on optimization methods for deep learning are provided in the advanced course CS-E4890-*Deep Learning* (https://mycourses.aalto.fi/course/view.php?id=28212&section=1). Thank you for pointing out the application of deep learning methods to ordinal classification problems. We have now added a discussion on ordinal label values in Round 0 and in the course book mlbook.cs.aalto.fi.

S15 *The course felt a bit too focused on image analysis although there are many applications also elsewhere, e.g. in text, audio and graphs. But I think this is very common in introductory courses to deep learning.*

A15 The new course edition now includes deep learning methods for text data (Round 5 - NLP). We also note that deep learning methods for images might be useful also for audio data. Indeed, audio signals can be represented (visualized) using images of their time-frequency energy distributions (see https://towardsdatascience.com/audio-classification-with-pre-trained-vgg-19-keras-bca55c2a0efe). The more advanced course CS-E4890-*Deep Learning* (https://mycourses.aalto.fi/course/view.php?id=28212&section=1) also covers deep learning methods for different data types including sequential (time-series) data and graph-structured data. You might also find the following advanced courses on speech and language processing useful: ELEC-E5550 - *Statistical Natural Language Processing*, ELEC-E5521 - *Speech and Language Processing Methods*, ELEC-E5510 - *Speech Recognition*.

S16 *Personally I was hoping to do the project work to learn more, but didn't due to time constraints and as there was some peer-reviewing etc. involved and that felt like too much work. Multiple-choice questions are easy for course staff, but sometimes unclear in their meaning, and not very helpful for the student. Much better results can be gained by forcing the student to do some actual coding work and/or at least set up and try out some necessary software. I didn't even follow the course Slack as there was no reason to, so the course remained quite distant for me as a whole.*

A16 In the new course edition we replace the student project with coding assignments that require students to implement deep learning methods by completing prepared code snippets. We will also try to better motivate

students to make good use of the course discussion forum.

S17 *The course can have more content.*

A17 See our responses A13 and A15.

S18 *So far, I have checked several courses offered by Aalto, to my best knowledge, I didn't find a good course that analysis time-series data using deep learning. So, in the future, could you add this topic in this course.*

A18 See our response A15.

S19 *Instead of doing all the examples on image data, perhaps a short example on how this can be extended to text or numerical data would be helpful, since majority of the real life applications are other than image based, and there are much fewer high quality tutorials from those areas. Obviously, image data is very visual and good for explaining, but personally I feel that what I'm lacking the most is the understanding how to move from image to other data types.*

A19 The new course edition now also includes a module on natural language processing (Round 5) We will also provide more information on visualization techniques that transform various data forms into images. Roughly speaking, we can apply deep learning methods for images to any other type of data for which we know how to visualize it effectively. For an in-depth discussion of natural language processing methods, we refer to the courses ELEC-E5550 - *Statistical Natural Language Processing*, ELEC-E5521 - *Speech and Language Processing Methods*, ELEC-E5510 - *Speech Recognition*.

S20 *Perhaps a stronger nudge from the staff to the students to start working on the project during the rounds would help in applying the knowledge gained from the rounds. Of course I understand that this is the responsibility of a student to get her things done, but sometimes gentle nudges make all the difference.*

A20 We now use a more rigid time schedule for the various course activities and assignments.

S21 *Aalto courses pages needs simplification and focus. -hard to find things on course pages. -too much noise on mycourses.*

A21 We have tried to simplify the structure of the Mycourse page for our course.

S22 *The workbooks are so excellent that you can self-study them anyway, so it would be great if the lectures gave extra insight beyond what is in the workbooks.*

A22 The new course will include lecture sessions to provide more background and overview of the concepts used in the notebooks.

S23 *More about nlp would ve been interesting.*

A23 The new course edition now introduces some deep learning methods for natural language processing (Round 5 - NLP). We also refer to the more advanced NLP courses ELEC-E5550 - *Statistical Natural Language Processing*, ELEC-E5521 - *Speech and Language Processing Methods*, ELEC-E5510 - *Speech Recognition*.

S24 *Just as a side comment, one additional topic for students could be combinations of ML and some simulation models that are able to generate a lot of data for analysis.*

A24 We have added Round 6 on generative adversarial networks that allow to generate synthetic data.

S25 *There should in my opinion have been just a little bit more mathematical formulations, in particular of backpropagation, which is at the center of the deep learning approach. Besides that, it was OK not to use almost any math for explaining the concepts.*

A25 The focus of this course is on building intuition and implementing deep learning methods with few lines of Python code. In particular, we do not require that students are familiar with the concept of gradients or partial derivations (backpropagation is just a method for computing these in an efficient manner) For a more detailed treatment of back-propagation, we refer to the advanced course CS-E4890-*Deep Learning* (https://mycourses.aalto.fi/course/view.php?id=28212&section=1).

S26 *There could have been more material for example about RNNs, GANs, and reinforcement learning.*

A26 The new course edition now also discusses generative adversarial networks (Round 6) as an example for how to use deep learning methods to generate (synthesize) data. For a discussion of recursive neural networks (RNN) and deep reinforcement learning methods, we refer to the advanced course CS-E4890-*Deep Learning* (https://mycourses.aalto.fi/course/view.php?id=28212&section=1).

Response to Student Feedback CS-C3240 Machine Learning

Main changes:

- course structured into fine-grained “topics” instead of rounds
- demonstrating Python implementations of methods
- discussing aspects relevant for trustworthy AI
- quizzes replaced by small Python coding assignments
- first half dedicated to lectures, second half to student project

detailed response to selected feedback organized as following topics:

- course logistics
- lectures
- assignments
- student project

Course Logistics

“A more structured course would've been nice as a student as well. Some weeks there was a quiz and some weeks there were no quiz and I would've preferred a shorter weekly quiz on the weekly lectures instead.”

We now use a more regular course schedule that includes short fast-paced coding assignments for each lecture topic. These coding assignments will replace the MyCourses quizzes.

“.. found it very hard to produce a topic which kind of left the project to the end of the course. …encouraging students to start the project earlier would probably lead to better results”

We will introduce the discuss the student project format right from the course start. Reference project reports from the previous course edition will be provided along with some example datasets that students might use for their projects. See Mycourses Section “ML Project”.

“lectures could also be more connected to the project if possible, i.e. "this week we talk about data, model and loss: choose a data model and loss for your project". :)”

We will use the lectures to demonstrate Python implementations of covered topics. These implementations can be used by students in their projects.

"It would've been nice to have a little more guidance on the projects, perhaps ""laskutupa"" type office hours where we could go over our projects individually on zoom with TAs."
We will encourage students to reach out to TAs. (see MyCourses Section "Need Help?)

"As a goal-oriented person I would have appreciated a clearer learning goals. Especially in the beginning of the course."
We have tried to make the learning goals clearer on the MyCourses page. This page now lists the course topics along with keywords for the main concepts for each topic. We also indicate grading scheme in the Section "Grading".

"I did not really like quizzes with time limit, since usually this gave me pressure and then I just tried to rush through the quiz as fast as possible, without properly thinking all of the things."
We replaced timed quizzes with small coding assignments that have to be submitted according to weekly deadlines.

“The assignments were a bit mixed bag, as their type changed in the middle of the course. Especially the later quizes were a bit too easy as they only covered single lecture per quiz.”

“…the purpose was to learn the theory of machine learning without calculation and practical exercises.”

“A few hands on implications (before the project) to be required would be nice. As to see how the stuff actually functions."

“..I would like to see some programming exercises.”

The new edition will involve small coding assignments that require students to complete prepared Python code snippets to implement ML methods. The new course edition will include small coding assignments in Python.

“When sharing files (e.g. powerpoints) it would be nice to have them in PDF, always.”

“Some of the materials were given as word documents (docx) or as powerpoints (pptx) such as peer review instructions and some slides. I would prefer pdf so that they are more easily accessible.”

We will provide all materials also in pdf format to the extend possible. For coding assignments and student project reports we use Python notebooks as the main file format.

“Also, it would be better, if exercise rounds were all before the project. It was hard to do both at the same time.”

“…More time for the project.”

We will use a different schedule, having the second half of course period dedicated exclusively to student projects.

“Many courses use slack. The forum we used in this course did not feel as good at all, and it would be nice to have all course forums on the same platform, so I suggest slack if possible.”

“Also more information for project and more time given for project would be helpful (couple weeks without lectures and after that deadline).”

“Student project should have been scheduled a bit later so that all the methods would have been covered before the project started.”

We have changed the schedule so that the students have more time exclusive for the student projects towards the end of the course.

“In my opinion, it is not necessary to send emails about every lecture. This causes the important information to get lost …One or two messages per week are max IF they are not very important announcements.”

We will reduce the use of email for staff-student communication.

“information…dispersed on multiple pages. simple timetable…would have been…useful.”

"The learning goals for the rounds 1-6 were not stated clearly enough and for the first couple of weeks the MyCourses page was pretty messy.”

“the weekly activities should be stated clearly so the students know what is expected of them every week, and the requirements for passing (e.g. quizzes, assignments, project) should be presented along with some guideline about work effort / timing for these.”

“a clearer structure would be beneficial”

“The MyCourses site is cluttered and finding a thing you are looking for can be slow.”

We have tried to improve the organization and clarity of the MyCourses page.

“would be to have an overview of the rest of the majors and minors courses. Like ""If you want to learn more about ANN, you can take the 'Deep Learning' course""…. Like tying the course into its programs and helping people choose what they want to learn more about.”

We now discuss related courses in the MyCourses page under Section “Related Courses”.

“As a goal-oriented person I would have appreciated a clearer learning goals. Especially in the beginning of the course, I was a bit at a loss as to what to do and to focus on.”

”it would have been nice to know about all these bonus points opportunities at the beginning of the course, …Now it was sometimes unclear what is expected from the student during this course.”

“More clarified information at the beginning of the course that how the points can be collected.”

We now provide a more detailed list of covered topics on the MyCourses page. Moreover, we discuss the grading scheme in the MyCourses section “Grading”.

“A bit more clear scheduling and correspondence. For example, having the same deadline every week or bi-weekly for assignments rather than the more arbitrary deadlines used now. Similarly, in the further editions could be nice if every deadline was already available at the beginning of the course. Eases up the prioritizing and timing effort for students.”

We now use a more regular schedule for course lectures and assignments. Moreover, the course schedule will be announced more clearly in the beginning of the course.

“The course did not really specify whether it was a technical course or an overall introduction to the topic.”

We now clarify the role of this course as the Bachelor level entry point to ML on the MyCourses page. The Mycourses page also includes a detailed list of topics along with references to the course book mlbook.cs.aalto.fi which should give a good idea about the level of the course.

“Some of the bonus points opportunities were not exactly available for everyone (e.g. short presentations at the end of a Zoom session, possible for only a couple students due to time issues) and I am not sure how I feel about these kinds of bonus points in general.”

The opportunity to earn bonus points by providing a presentation was open for every student. There was no limit on the number of students that can earn bonus points. We will put more effort into indicating how bonus points (if any) can be obtained. There is now a new MyCourses section “Grading” that includes all details of the grading scheme.

”And the Zoom-sessions where you could better your grade were absolutely humiliating because it was recorded”

We make clearer that the private chats will not be recorded by default. There is also a new MyCourses section “Need Help?” that explains how to reach course staff.

Lectures

“The lectures were not coherent, I was unable to get an idea of the big picture.”

“I would suggest using the first lecture to discuss the whole topic of machine learning, explaining the basic ideas of supervised and unsupervised machine learning with concrete examples and use cases. Then it would be easier to delve deeper into how machine learning works, i.e. the three components of ML and the different models.”

“Just would want a clearer introduction of what I'm going to learn during this course: what ML is in general, what kind of things can we do with ML (in different industries, e.g. self-driving cars, material informatics, medical diagnostics, finance), and how it relates to other things, such as AI (which is grouped together with ML in many cases) and data science (which uses similar methodologies).”

“sometimes I didn't understand how these different things and methods connected to each other. Perhaps some clear flow charts would help. Also I think those quizzes were sometimes too difficult since I had trouble to even understand question and answer alternatives.”

We now put more effort to provide the “big picture” at the course start. The first lecture will discuss the plan of the course, i.e., how the individual lectures are related with each other. We now also list the detailed course topics (syllabus) on the MyCourses page (Section ”General”).

“too much information and sometimes I didn’t understand how these different things and methods connected to each other. Perhaps some clear flow charts would help”

We revised the course material to include more visualizations of the concepts.

“In the same way, I think it would be motivated to show in python in a jupyter notebook how things behave. Instead of having hand-drawn graphs on presentations, you could show with real(or simulated data) what happens when you change parameters or do the ML.”

The new course edition will involve much more demonstrations and assignments for ML methods in Python.

“the constant answering to student questions (especially during the beginning of the course) disrupted the learning from the lectures and the lecturer was easily led off topic.”

I will collect questions during my lecture and answer them “batch-wise” at regular time intervals

“The lectures contained too much repetition”

“One of my personal favourite courses is ""Statistical inference"" which I completed in 2019. The lecturer jumped between his presentation and R studio to show what the theory meant in practice.”

“During the lectures i felt pretty lost sometimes when there were so many questions asked and the lecturer stopped in the middle to answer them. The flow of the lecture was disturbed. The questions and the answers also felt like ""over course"" and confused me as a beginner. Maybe in the future answer all questions in one go in the end :) “

We will try to reorganize the lectures according to these comments: We will answer questions only at dedicated breaks during the lecture. We will also put more effort into illustrating the practical implementations of ML methods directly during the lecture.

“I would have liked more concrete examples around the models and mathematical formulas.”

“I know just the basics of python and I couldn't really follow the python lectures because I got a bit confused with the code sometimes. There could have been those kind of ""machine learning in practice"" lectures more in Excel too because those could have been easier to understand.”

“I don't have… background in machine learning and sometimes the lectures were a bit overwhelming because of so many new terms, and therefore I had hard time understanding for example loss functions and how you should use them.”

The lectures will now include demonstrations for how ML methods can be implemented in few lines of Python code. These demonstrations should help students to grasp theoretical concepts such as “models” and ”loss functions”.

“In the beginning I experienced some confusion over where some topics fit in in the bigger picture or in a ML project pipeline. Unsure if something was implicit in a model, a design choice or needed to be implemented by a user. An example would be my mistaking ERM and GD as part of some specific model and not more general. Thinking it over, I'm not sure where this confusion stemmed from. In hindsight the course structure seems very logical.”

We put more effort into clarifying the role of ERM ad GD as “generic” optimization principle and method that can be used for different combinations of model, data and loss.

“Maybe building on the data+model+loss tree as new things are introduced, to have a visual aid for where everything fits in and what the relationships exist could be helpful? I would appreciate getting still more visual presentations as opposed to mathematical notations.”

Excellent suggestion. We will put more effort into pointing out the specific design choices for data, model and loss used by specific ML methods. These design choices are surveyed in the revised Chapter 3 of the course book http://mlbook.cs.aalto.fi

“Interactive trainings of key concepts - I mean visualizing when one changes model/parameters by showing the changes in model outcomes. could be a fixed dataset with just selected model/parameter options.”

We now demonstrate the implementations of ML methods during lectures to better visualize and illustrate the underlying principles.

“coding assignment. let students learn a linear hypothesis for data point whose features and labels are completely unrelated (uncorrelated). see if students find out that there is might not be any good hypothesis.”

The new course edition now includes small coding assignments instead of theory quizzes.

“Although I was familiar with many of the concepts, there where some things which were also new to me as well. On the other hand, it can be that some of the things (e.g. in decisions trees, formulas from Duda book) may be too much for an introductory course.; At least in the beginning of the course materials were very hard to find from mycourses and some of the Rounds did not follow chronological order.”

We now put more effort to provide the “big picture” at the course start. The first lecture will discuss the plan of the course, i.e., how the individual lectures are related with each other. We now also list the detailed course topics (syllabus) on the MyCourses page (Section ”General”).

Assignments/Exercises

“I would say that adding more practical exercises would be a huge improvement to this course, as, without it, I have a feeling I learned very little.”

"Would've enjoyed more hands-on exercises about implementing the algorithms etc. instead of the quizzes. Abstraction and ease of use is good but ""LinearRegression().fit(X, y)"" doesn't really teach the inner workings.”

"The course needs more practical assignments instead of just the quizzes IMO. Some smaller assignments where you need to implement a machine learning task in python or excel would support learning much more than answering a quiz.

“I would have liked to see more coding tasks or some practical exercises, although I understand that there are other courses for these purposes.”

The quizzes will be replaced by small coding assignments that require students to complete prepared Python code snippets.

“I think there needed to be more concrete assignments where students build ML models.”

“I think there should have been more practical exercises about machine learning. I think the assignments should have been about implementing some machine learning model in practice. Just theory gets boring quickly.”

“Course could have more assignments,…implementing own ML models.”

”For example lets say quiz was about k-means, it tested only the little parts of the k-means and it didn’t test the understanding of what it really does and what it can do for a certain machine learning model.”

“There could have been some more actual assignments like algorithm coding instead of just quizzes. It felt a bit hard to suddenly from just doing quizzes to go to completing an entire project without any kind of intermediate assignments.”

“…have expected to have more hands-on programming exercises”

“It would be beneficial to teach implementing all of the models as well. This would certainly support the learning process.”

“More practical assignments would have been appreciated (e.g. ""fit model H on the dataset X, what is the weight vector?"" or ""fit these models and compare their training and validation errors, which model performs best?"")”

“Making the students create, for example, a linear regression model themselves would serve as a good practice.”

“quizzes could be split better, for example after every lecture …a quiz”

“I think it would be better if there where more weekly assignments than the quizes. That would motivate the students to do more than bare minimum.”

The quizzes will be replaced by small coding assignments that require students to complete prepared Python code snippets. We will have one such fast paced coding assignment for each lecture topic.

“Material was hard to understand, maybe some kind of web material with code examples good be better. Also the grading points are confusing: seems that there were a lot more points than 60 from assignments.”

“There could have been more exercises like the machine learning problem formulation on the first round. I think that those kind of exercises would have taught me more than quizzes”

We will now have two peer grading rounds for the student projects. The first round involves only the ML problem formulation of the student project. The second peer grading round involves the full project report.

“Also, since we did not get to apply most of the ML methods we were taught, my understanding of them was left to rudimentary at best”

“it is good to do something hands on (project). However, being new to machine learning, it felt hard at first.;”

”… wish there had been at least some practical tasks, because doing the project and implementing the functions I had learned the theory about really helped me understand the subject better. “

The quizzes will be replaced by small coding assignments that require students to complete prepared Python code snippets. We will have one such fast paced coding assignment for each lecture topic. The lectures will now also include demonstrations of how to implement ML methods using few lines of Python code.

“I would have preferred more traditional PDF assignments with math proofs or hands-on computation with Python. I understand that this is not the hands on course but something more involving than quizzes would be better.”

“The assignments could be more hands-on style. Less emphasis on the pure maths side and more on the implemented algorithms.”

“The course was very theoretical and while the project was trying to fill that gap between theory and reality, the distance between them was daunting. I think it would be very beneficial to have easy assignments every week that shows in practice most of the theoretical ideas taught during lectures. The quizzes didn't support my learning that much, too much grade weight on them considering how tricky some of the questions were.”

The quizzes will be replaced by small coding assignments that require students to complete prepared Python code snippets. Moreover, the lectures will now also include demonstrations of how to implement ML methods using few lines of Python code.

“….lack of interaction and hands-on practice.”

“I get that this is not so much a hands-on course, but still personally I learned most doing some tutorials from tensorflow website.”

“The exercises didn't really reflect how to do machine learning.”

“If it is expected to create a project at the end of the course students should also have some hands on exercises where you would implement some of the theory in practice.”

“no hands-on learning and therefore learning to apply methods was not part of the course. Maybe in the future combine theory and hands on learning..”

See our response on the previous slide.

Student Projects

“It took me awfully long to form the project's algorithms in Python. It was emphasised that one doesn't need to code but it still was necessary if the method used would differ from linear regression implementable in Excel for example. Guidelines for what kind of a project receives full marks without coding ought to be provided.”

The new course edition will focus more on the implementation of ML methods using Python. Lectures will include live coding demonstrations for how to implement ML methods using few lines of Python code. Theory quizzes have been replaced by small coding assignments that requires students to complete short Python code snippets that implement ML methods. We will provide examples for ML projects that received top grades in the previous course edition. Moreover, we will publish the peer grading questions at the course start and let students comment and suggest modifications.

“Peer grading with the first exercise was a good idea. But it's not a good idea with this big project. Because some students haven't learn anything during the course and that means they can't grade the project correctly. They just can give all points because they don't see any mistakes. In contrast, some students are very exact and they see all mistakes. So they can give less points. So, this peer grading is unfair and unequal.”

“The project instructions and the peer-grading instructions could have been clearer. I also think that some of the peer-grading scoring metrics should have been more flexible than just e.g. 0, 1 or 4.”

The new course edition will focus more on the implementation of ML methods using Python. Using the same tool (Python) for the student projects should make the peer grading process easier. Moreover, we will publish the peer grading questions at the course start and let students comment and suggest modifications.

“Since I do not have programming or strong mathematical background, I felt that completing the assignments and especially the student project was really hard. I did not understand how you would be able to create a student project without coding anything, and finding a topic was a struggle for me since I felt I am not capable of assessing suitable topics for ML (I chose a dataset that was not good eventually, which led to re-doing the whole project at the end of the course).”

The new course edition will focus more on the implementation of ML methods using Python.

“The guidelines for the project were very limited and the true contents it required were found on the review questions sheet. Also the review questions were vague and maximum points could be obtained even if the whole method (polynomial regression for example) was understood completely wrong. The questions also had very few options (for example training error was told, or it wasn’t), there were no middle ground. We had no examples of data sources, very few examples of project ideas (very few applications of machine learning on the course itself) and this made it really hard to even come up with a project idea.”

We provide detailed information about student project format right at the course start. This information includes example project reports from previous course edition and example datasets that might be used for student projects. Moreover, we will publish the peer grading questions at the course start and let students comment and suggest modifications

“I hope that we could have had only the mycourses assignments, and maybe more questions in those starting from a more basic level, since it is a first course in ML (at least for me). Also the examples of previous student projects conflicted with the overall message that we would not need to implement highly advanced methods or programming to create our project - I would have wished easier examples to compare with. I felt like this should be described as a more advanced course on ML based on the graded elements, rather than a basic course for everyone to follow regardless of their background. Because I felt underqualified from the beginning of the course, it also affected my motivation a lot”

We provide more detailed prerequisites on the Mycourses page which now also includes a detailed list of topics. The revised Mycourses page should help students to decide if this course is suitable for them. A new focus of the course is on the implementation of basic ML methods using few lines of Python code. These implementations will be demonstrated during lectures and practiced during small coding assignments (which replace the theory quizzes). We also provide a new list of reference projects that are aligned with the expected level of approaches.

“final project info came too late”

“The project was ridiculous as some just copied the idea of the example project and others came up with a deep neural network.”

“The project topic was in my opinion too wide. I would need some more guidelines for picking up a topic for my project. Some example topics or websites where to get suitable dataset would have been really helpful.”

“more complete examples of machine learning projects/use cases”

We will introduce the discuss the student projects right at the course start. Reference project reports from the previous course edition will be provided along with some example datasets that students might use for their projects. See MyCourses Section “ML Project”. The course will now have a stronger focus on the Implementation of ML methods in simple Python code which should support students for their project work.

“but as the focus was on trying out different models and less on producing cool ideas, as I repeat myself, a pool of problem ideas would have been nice.”

“The scope of the project was not limited in any way and students were able to use machine learning models which were not even part of the course. This is kind of problematic for the peer review ….”

We will introduce the discuss the student projects right at the course start. Reference project reports from the previous course edition will be provided along with some example datasets that students might use for their projects. See MyCourses Section “ML Project”. The course will now have a stronger focus on the Implementation of ML methods in simple Python code which should offer more guidance for students in their project work and during the peer grading.

“all of the exercises returned have been peer-graded, including the course's Machine Learning Project, worth 40% of the course's grade. Given that the course is a ""beginner"" course to ML, it seems absurd to have people with flimsy knowledge on the subject to grade these quite complex projects…”

We provide detailed information about student project format right at the course start. This information includes example project reports from previous course edition and example datasets that might be used in student projects. The new course edition will also have a stronger focus on the implementation of ML methods using few lines of Python code. Lectures will include live coding demonstrations and theory quizzes have been replaced by small coding assignments. Overall, the new course edition will provide more guidance for students for their ML projects. Moreover, we will publish the peer grading questions at the course start and let students comment and suggest modifications

"It would've been nice to have a little more guidance on the projects, perhaps ""laskutupa"" type office hours where we could go over our projects individually on zoom with the teaching assistants. Understandably the course might be too large for that. Overall I enjoyed the course!"

We will encourage students more explicitly to contact course staff in case of questions that cannot be solved via the discussion forum.

"The tools for the course project were a bit unclear."

The new course edition makes consistent use of Python notebooks which can be edited and run via the Jupyterhub server https://jupyter.cs.aalto.fi/hub/login

"Project was bad idea if you not need to program. There wasn't exercises in course which means no one does nothing."

We now use Python as the main tool for practical course activities.

“The project was a little unclear even though there were lectures and exercise sessions about it.”

“Maybe there could be more info about project”

“More definitive project instructions in general.”

"The project would have benefitted from a ""checkpoint"". Finding a good project topic is hard.

“make clear that there is no need to use deep learning. Stick more to scikit-learn methods”

We provide more detailed information about the student projects right from the start of the course. The new course edition will also put more emphasis on the practical implementation of basic ML methods using Python libraries such as scikit-learn. These Python implementations will be discussed along with the corresponding theory during the lectures. We will also highlight the possible use cases of these Python implementations for student projects.

“The ML-project felt overwhelmingly big and complicated as we hadn't done anything practical before - I would suggest that this course should be more about coding/practical exercises, as the project feels like way too much when you haven't really done anything before i.e., your very unsure about if you're doing it right and which sorts of methods would be the best.”

The new course edition puts more emphasis on the implementation of ML methods using few lines of Python code. Lectures will include live coding demonstrations and theory quizzes have been replaced by small coding assignments. Overall, the new course edition will provide more guidance for students for their ML projects.

“Grading of the student project was somewhat clunky in that sense that it generally penalized making difficult and more challenging project in favour of doing very simple and unimaginative projects.”

The main purpose of the student projects is to practice the appropriate use of ML methods. A main focus is on the validation of and selection between different ML methods. Nevertheless, the peer grading questions include also an assessment of the originality of the proposed ML application. We will publish the peer grading questions at the course start and give students the opportunity to review these questions and proposed modifications/improvements.

“There could have been some more actual assignments like algorithm coding instead of just quizzes. It felt a bit hard to suddenly from just doing quizzes to go to completing an entire project without any kind of intermediate assignments.”

The new course edition includes small coding assignments that prepare students for the project work.

“I also feel like I'd have needed more support in the making of the student project.”

We will put more effort in encouraging students to ask questions in discussion forum and reach out to TAs. There is also a new MyCourses section “Need Help?” where students can reach out to course staff.

“Project was very confusing at first. It was hard to know what will I be capable of implementing by the end of the course, and thus wasted time on thinking about wrong kind of subjects for the project. I also would have liked to do more problem solving during the course.”

We will provide reference projects and example datasets right at the start of the course. One such example is the prediction of weather characteristics (3 day ahead temperature) using FMI data. We will now also demonstrate the implementation of ML methods in Python right from the start of the course during lectures. Moreover, Python skills that might be useful for the student projects will be practiced during small coding assignments. These coding assignments replace the quizzes used in the previous course edition.

“The project assignment was obviously great.; More support and guidelines for project ideas could have been provided. I like the freedom given to students to decide what to work on, but I think I could have focused more on the methods and work, if coming up with the project idea would not have taken as much time.”

“Also regarding the project I found it very hard to come up with a topic…encouraging students to start the project earlier would probably lead to better projects.“

”More definitive project instructions in general. I suggest providing a fixed amount of topics and corresponding datasets for the students to choose from.”

“The only improvement that I can think is that maybe you could provide few project topics for student's who struggle to come up with their own topic.”

We provide more detailed information about student projects right from course start. Moreover, we provide reference projects from last year and also present some example datasets (e.g., FMI weather data) that might be used for the student projects.

“we were required to do practical project without really any teaching about practical stuff”

“I think it would be nice if were maybe a couple more programming lectures because sometimes the theory alone was hard to understand. However, I understand that there is maybe no time for more programming and there is the course exclusively for Python in machine learning.”

The new course edition teaches how to implement ML methods in Python. These implementations will be discussed during the lectures and practiced during small coding assignments.

“i also don't think that peer-reviewing is a good thing in this class as some students don't know how to apply the rules and just because they disagree with your work they wont give you your points even tho it might not be incorrect.”

“Peer review/grading is in my opinion less reliable than course assistant review/grading.”

Students can report reviews that they consider flawed for some reason. TAs will look into these cases. Moreover, TAs will also participate during the peer-grading process. In particular, TAs will provide peer-reviews (grading) for reports that received mixed peer grades.

APPENDIX D
PEER FEEDBACK

Recommendation letters of education coordinators available upon request.