Introduction to intelligent systems

Project work

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Project work

Project work

- Groups of 3 students
  - Under special circumstances, you can be fewer/more - talk to me
- Design and conduct an experiment
- Write and hand in group report.
  - 5-pages.
  - Individualized (who did what?)

Week 1

Come up with idea The first step is to come up with an idea for your experiment—something you would like to study. You can formulate this as a research question, and state your expectations and tentative explanation as a hypothesis.

Design experiment Next, you must design your experiment. Agree on a protocol to follow and write it down. Ideally, the experiment should be designed so carefully that others would be able to reproduce the experiment and get the same result except for statistical variation.

Decide on your approach and start building At this time, you should also agree on which method to use to analyze the data, and consider how large a sample size you need to support your claims. You should think about what code you need to write, or existing toolboxes you need to familiarize yourself with, to be able to conduct your experiment. Start prototyping your experimental setup.

Deliverables

- Description of experiment idea
- Experimental plan

Week 2

Build your experimental platform At this time, you should put together the computer code etc. you need for your experiment. Test that everything works as required and finalize your setup. Perhaps it could be a good idea to run a small pilot study to make sure everything is in place.

Carry out your experiment Now, you are ready to carry out your experiment. Follow your protocol carefully and record the results. If something goes wrong or you realize there is an issue with your experimental design, you might need to go back to the previous step and modify your design.

Start writing At this time, you should also start to draft your report.

Deliverables

- Experimental data
- Report draft

Week 3

Document and communicate your experiment Finally, you must write up a report, following the template we have given you. The report must be 5 pages long, and you must hand it in as a pdf file.
The report must clearly describe the experimental design and protocol, include visualization and summaries of the data gathered in the experiment, present the reults of the experiment, and include a discussion where you comment on perspectives, ethics etc.

Deliverables

- Final report

Experiment

- The experiment must be centered around a problem where artificial intelligence or machine learning is relevant
- The experiment can be based on the methods and computer code discussed in the course, including
    - Image classification
    - Symbolic AI
    - Linear / neural network regression
    - K-means clustering
    - Text search using Okapi
    - Audio classification
    - Tabular value iteration / q-learning
- You must gather your own experimental data

Report

- 5 pages of main content (reasonable font size and margins) + front page + references + (optional) appendices
- Follow the IMRaD format
- Include a short abstract (on the front page)
- Include appropriate visualization of the dataset
- Include statistical considerations regarding sample size
- Back up claims regarding recognition up by statistics
- Include your own code as an appendix or link to e.g. gitlab
- Write using LaTeX

Individualization

Krav til indvidualisering ifølge studieordningen:

- Ved gruppeopgaver/gruppeprojekter, hvor der er stillet krav om individualisering, skal det tydeligt fremgå, hvem der har ansvaret for de forskellige kapitler/afsnit i opgaven.
- Ved større gruppeprojekter kan generelle, beskrivende afsnit som indledning, problemformulering, afgrænsning konklusion og lignende udarbejdes i fællesskab af gruppen og behøver ikke være individualiseret.
- Flere studerende kan godt være (hoved-)ansvarlige for det samme kapitel/afsnit.
- En gruppeaflevering anses ikke for at være individualiseret, hvis det af afleveringen blot fremgår, at de studerende har deltaget ligeligt i arbejdet eller lignende.

Assessment criteria

In addition to the requirements above, the degree of fulfillment of following objectives will be taken into account in the assessment of the project:

- Description of key components of intelligent systems: Sensing and active data collection, machine learning, evaluations and communication
- Application of AI tools to data (such as image, audio, text and games)
- Discussion and analysis of performance
- Application of visualization techniques for evaluation of performance and basic debugging
- Application of scientific Python programming tools
- Discusssion of the role of AI tools in the chosen application domain
- Discussion safety and ethical challenges in AI, biases and stereotypes, privacy and societal impact

Project work: Activities in the project period

Project period

Assistance Groups can book consultations with our teaching assistants in 30 minute times slots. They can help with almost everything.

Consultations Groups can book individual consultations with the teacher in 20 minute time slots.

Feedback sessions Two times during the period we will meet 4–5 groups together with the teacher to present project status and give each other feedback.

Recap lectures Depending on your demand, we will give recap lectures in any topic from the course or beyond.

Booking consultations

- You may book 1 TA + 1 teacher time slot at a time. After the consultation, you may book again.
- We have hours for at least 2 TA + 2 teacher consultations per group.
- Book consultations by writing your group ID in the Google sheet

Show Google sheet

Report your project groups to us

- Sign up your groups on DTU Learn
- Report your project title and keywords to us via the Google sheet (Link on DTU Learn)
- If you miss a few group members, write on the Discussion forum on DTU Learn.
- Groups should be formed today.

Show Google sheet

Collaboration agreement

- At your first group meeting, go through the points in the collaboration agreement (download from DTU Learn)

Show collaboration agreement

Project topic ideas

Visual learning
- Image recognition in variable lightning conditions / with obstruction
- Recognition of rotated objects
- Face recognition / facial expression recognition

Audio learning
- Classify presence or absence of music
- Noise level vs subjective noise level
- Tone / instrument classification

Text modeling
- Okapi search performance evaluation (e.g. in parilament documents or Wikipedia)
- Sentiment scoring compared with subjective evaluation (e.g parliament opening speeches or RSS news feed),

Other modalities
- EEG analysis
- Cardiac monitoring

Project examples

Emotional image analysis	Image classification with convolutional neural network and transfer learning
Generating hand-drawn circles	Image generation using generative adversarial network
Arousal in danish news media	Sentiment analysis of news articles using the AFINN lexicon
Learn to play "Game 2048"	Deep reinforcement learning using policy gradient methods
Super-resolution imaging	Image up-scaling using generative adversarial network
Decoding mental states in EEG	Binary classification using support vector machine
Recognition of hand-written digits	Image classification using convolutional neural network
Face recognition	How many training images are needed for face recognition using convolutional neural network
Learn to play "Snake"	Reinforcement learning using tabular Q-learning
Colorizing black/white images	Comparison of convolutional neural network and U-net on image colorization task
Counting objects in images	Exploration of multi-task convolutional neural network for counting objects in images
Most readable background color	Comparison of nearest neighbor, logistic regression, and neural network for classifying text readability
Sign language recognition	Image classification of sign language letters using convolutional neural network

Final grade

Final grade is a weigted avereage of

- Individual written exam (40%)
- Individualized group report (60%)

Matchmaking

■ For those interested, we will host a match making session shortly.