IKT441 - Deep Neural Networks - 2019

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The lecture plan is tentative. There will be changes.

1 Lecture plan

1. Introduction to neural networks and perceptron
2. Decision Trees and Random Forest
3. Support Vector Machine
4. Deep Feed Forward Neural Networks
5. Convolutional Neural Networks
6. Deep Autoencoders
7. Recurrent Neural Networks
8. Reinforcement Learning (Per-Arne Andersen)
9. Deep Reinforcement Learning (Per-Arne Andersen)
10. Generative Adversarial Networks

2 Reading list

- Lecture Introduction to Neural Networks
  - Andrew Ng and Kian Katanforoosh CS229 Lecture Notes chapter 1 and 2 `http://cs229.stanford.edu/notes/cs229-notes-deep_learning.pdf`
- Lecture Deep Feed Forward Networks
  - Andrew Ng and Kian Katanforoosh CS229 Lecture Notes chapter 3 and 4 `http://cs229.stanford.edu/notes/cs229-notes-deep_learning.pdf`

Small assignments

- Contributes 10% of the grade.
- There will be one assignment per lecture.
- As part of the portfolio, write a **one page** report per assignment.

2.1 Neural Networks

In this task you are suppose to implement 2 types of mulilayer Perceptrons: 1. Using only Python. 2. Using Keras

- Download the Ecoli dataset: `https://archive.ics.uci.edu/ml/datasets/Ecoli`
- Predict the two classes: cp and im (remove the rest of the dataset).
- Make the necessary adjustments to the data.
- Implement and test a Multilayer Perceptron from scratch using only Python and standard libraries.
- Implement and test a Multilayer Perceptron using Keras.
- Choose the network architecture with care.
- Train and validate all algorithms.
- Make the necessary assumptions.
- You can be in groups of up to 3.
- Handin: One page report to be delivered at the end of the semester.

2.2 Random Forest

In this task you are suppose to implement 2 types of decision trees: 1. Using only Python. 2. Using random forest with a library such as sklearn.

The classification should be to predict recurrent cancer.

- Download the Breast Cancer dataset `https://archive.ics.uci.edu/ml/machine-learning-databases/breast-cancer/breast-cancer.data`
- Predict the two classes: Not-recurrent and recurrent
- Implement and test a decision tree from scratch using Python and standard libraries.
- Implement and test random forest with a library such as sklearn.
- Choose the network architecture with care.
- Train and validate all algorithms.
- Make the necessary assumptions.
- You can be in groups of up to 3.
- Handin: One page report to be delivered at the end of the semester.

2.3 Support Vector Machine

In this task you are suppose to implement several types of support vector machines using a Python library.

The classification should be about Abalone sex.

- Download the Abalone dataset `https://archive.ics.uci.edu/ml/datasets/abalone`
- Predict the three classes: Male, Female and Infant
- Try linear-, polynomial-, Gaussian-, and other kernels. Which works best and why?
- Choose the network architecture with care.
- Train and validate all algorithms.
- Make the necessary assumptions.
- You can be in groups of up to 3.
- Handin: One page report to be delivered at the end of the semester.

2.4 Deep Feed Forward Neural Networks

Will be made available soon

2.5 Convolutional Neural Networks

In this task you are suppose to implement a convolutional neural network using Keras.

The classification should be about food.

- Download the food 11 dataset `https://mmspg.epfl.ch/food-image-datasets`
- Predict the 11 classes: Bread, Dairy product, Dessert, Egg, Fried food, Meat, Noodles/Pasta, Rice, Seafood, Soup, and Vegetable/Fruit
- Try some standard networks convolutional networks before more complex ones.
- Hint: Start with a subset of the dataset
- Choose the network architecture with care.
- Train and validate all algorithms.
- Make the necessary assumptions.
- You can be in groups of up to 3.
- Handin: One page report to be delivered at the end of the semester.

Will be made available soon

2.6 Deep Autoencoders

Will be made available soon

2.7 Recurrent Neural Networks

Will be made available soon

2.8 Reinforcement Learning (Per-Arne Andersen)

Will be made available soon

2.9 Deep Reinforcement Learning (Per-Arne Andersen)

Will be made available soon

2.10 Generative Adversarial Networks

Will be made available soon