Master Thesis Term Paper Topics

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1 Topics

1-Autoencoder neural networks for fraud and anomaly detection
Autoencoder neural networks for fraud and anomaly detection Fraud detection is a challenging task. It is challenging firstly because the number of fraud cases is very small relative to the total data population. Secondly, the fraudsters are constantly coming up with a new scheme to circumvent fraud detection models and systems. Traditional fraud detection models use a combination of expert rules and statistical models. More recently, a number of articles have shown successful fraud detection based on machine learning techniques. One such method is to use an autoencoder (deep) neural network with multiple hidden layers. These techniques are based on the idea of unusualness detection or anomaly detection.

In this project, the focus is on a showcase machine learning application to fraud and anomaly detection. The data will consist of both numerical and categorical features. This project is particularly interesting for students who want to gain exposure to financial data and the state of art application of autoencoder neural networks such as variational autoencoder with categorical variables.
Prerequisite: Programming skills, interest in Computer Vision, Predictive Modeling, Deep Learning and Tensorflow.

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References
1-https://www.ru.nl/datascience/education/student-projects/
2-https://arxiv.org/pdf/1709.05254.pdf
3-https://arxiv.org/pdf/1802.06360.pdf

2-Neural networks for the automatic classification of articulatory features in speech

Articulatory features are properties of speech sounds. These AFs are used as intermediate representations of the speech signal in an existing computational model of human spoken-word recognition. The aim of this project is to investigate whether it is possible to improve this using the latest deep neural network technologies.

This project includes determining the best method to use for the automatic classification of AFs, and building the best models for the classification task. Since the amount of available data is limited, an important question in this project is how to deal with a restricted amount of data. This project thus can be viewed as a right-data project rather than a big-data project.

Prerequisite: Programming skills, interest in Natural Language Processing, Deep Learning and Tensorflow.

References
1-https://www.ru.nl/datascience/education/student-projects/
2-https://www.isca-speech.org/archive/icslp_2000/i00_4330.html
3-https://www.era.lib.ed.ac.uk/handle/1842/981

3-Deep neural networks model for Caption generation from medical images

Describing the content of an image using human language is a topic that has gained significant interest in recent years. Implementing a method for this task on the line with our previous research. Exploiting scene context for image captioning.

Prerequisite: Programming skills, interest in Computer Vision, Natural Language Processing, Deep Learning and Tensorflow.

References
1-https://www.ru.nl/datascience/education/student-projects/
2-http://openaccess.thecvf.com/content_cvpr_2017/html/Zhang_MDNet_A_Semantically_CVPR_2017_paper.html

3-https://synapse.koreamed.org/DOIx.php?id=10.3348/kjr.2017.18.4.
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4-Development of deep neural network for Scene Categorization and Prediction

Humans can recognize scenes over many different modalities, for instance, cartoon and stories. Developing and apply deep neural networks model for transfer learning in order to learn scene representations that transfer across modalities and improve categorization of scenes.

Prerequisite: Programming skills, interest in Computer Vision, Predictive Modeling, Deep Learning and Tensorflow.

References

1-https://www.ru.nl/datascience/education/student-projects/
2-https://www.cv-foundation.org/openaccess/content_cvpr_2015/html/
Wu_Deep_Multiple_Instance_2015_CVPR_paper.html
3-https://www.sciencedirect.com/science/article/pii/S1877050918309335

5-A study of Human activity detection using machine learning methods

Implementation and compare deep learning and Hidden Markov regression model methods for the identification of human activities from the availability data sets, based on the current state of the art algorithms for this task.

Prerequisite: Programming skills, interest in Computer Vision, Deep Learning.

References

1-https://www.ru.nl/datascience/education/student-projects/
2-https://onlinelibrary.wiley.com/doi/full/10.1002/widm.1254
3-https://link.springer.com/chapter/10.1007/978-3-642-44964-2_8
4-https://link.springer.com/chapter/10.1007/978-3-540-72348-6_3

6-Comparing features from natural image statistics

In this project, you will be comparing various techniques for learning features from image statistics. Various properties, like, robustness to noise, translation, rotation, match to human eye statistics, etc, will be studied.

Prerequisite: Programming skills, interest in Computer Vision, Deep Learning.

References
1-https://wiki.aalto.fi/display/2PN/Machine+learning+and+data+science+
project+topics
2-https://ieeexplore.ieee.org/abstract/document/5539947
3-https://ieeexplore.ieee.org/abstract/document/5437761
4-Hyvärinen, Aapo, Jarmo Hurri, and Patrick O. Hoyer. Natural image
statistics: A probabilistic approach to early computational vision. Vol. 39.
Springer Science & Business Media, 2009.

7-Translation invariance in deep convolutional neural networks
Modern deep neural networks (DNN) reach phenomenal, superhuman performance in image classification tasks. However, their inner life is not understood all that well. Among other things, they easily stumble into image modifications that are trivial to us humans: for instance, merely translating the input image often leads to large changes in predictions. In this project, you will implement a DNN image classifier based on a high-quality downsampling operation (using, e.g., the Lanczos filter) and compare the resulting network's resilience to translation and other simple image modifications against standard max-pooling.
Prerequisite: Programming skills, interest in Computer Vision, Deep Learning.

References
1-https://wiki.aalto.fi/display/2PN/Machine+learning+and+data+science+
project+topics
2-https://arxiv.org/abs/1805.12177
3-https://arxiv.org/abs/1312.5402

In Addition
1-Incremental Processing with Neural Networks.
2-Named entity recognition.
3-Automatic Text summarization.
4-Speech recognition and breaking.
5-Native language identification.