Artificial Intelligence Course (CS 550) - Timetable

Location: ISU, STEM building; Room: T302; Time: 16^{30} - 17^{45}

Date	Day	Type	Part	Details
20.01.2020	Monday	Lecture	Applied Math	**Introduction:** Class syllabus overview; Discussion of grading policy; Topics overview; Software platforms; **Linear Algebra:** Scalar fields; Vector spaces; Linear dependence; Linear combinations; Bases; Dimension; Morphism; Isomorphism; Classification of morphisms; Linear functional and dual space; Dual bases; Brackets and Reflexivity; Change of basis;
22.01.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises.
27.01.2020	Monday	Lecture		**Linear Algebra:** Linear transformations; Transformations as vectors; Products; Polynomials; Inverses; Matrices; Matrices transformations; Change of basis; Range and null-space; Rank and nullity; Eigenvectors and eigenvalues; Determinant; Singular Value Decomposition (SVD); Machin Learning Application: Dimensionality reduction; Principal Component Analysis (PCA);
29.01.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Home Work 1**
03.02.2020	Monday	Lecture		**Probability:** sigma-algebra; mesure; probability; Bayes' rule; random variable; expectation, Variance and Covariance; law of large numbers; Common probability distributions; Central limit theorem; **Information Theory:** Measure of information content; Entropy; Cross-entropy; Kullback-Leibler (KL) divergence;
05.02.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Feedback on Home Work 1**
10.02.2020	Monday	Lecture		**Numerical Computation:** Metric space; Metrics in Euclidean space; Sequences and limits; Functions; Limits of functions; Continuous functions; Derivatives; Partial derivatives; Total derivative; Directional derivative; Gradient of the function; Local extremums; Gradient descent method; Hessian matrix of continuous functions; Schwartz's theorem; Newton's method; Reverse mode differentiation;
12.02.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Home Work 2**
Midterm Exam I (2 hours)				

17.02.2020	Monday	Lecture	Machine Learning	**Overview of Machine Learning Basics:** Learning algorithms; Supervised and Unsupervised learning; Reinforcement learning; Hyperparameter and model selection; Training set, validation set and test set.
19.02.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Feedback on Home Work 2**
24.02.2020	Monday	Lecture		**Linear Regression:** The normal equation; Gradient descent; Features, feature engineering and feature importance; Overfitting and underfitting; Estimators, bias and variance; Bias/variance trade-off; Bias-variance decomposition; Regularization.
26.02.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises.
02.03.2020	Monday	Lecture		**Probabilistic modeling:** Logistic regression; Training and cost function; Naive Bayes algorithm.
04.03.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Home Work 3**
09.03.2020	Monday	Lecture		**Kernel methods:** Decision boundaries; Maximum margin classifiers; Support vector machine (SVM).
11.03.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Feedback on Home Work 3**
16.03.2020	Monday	Lecture		**Unsupervised Learning:** Clustering algorithms,K Means Clustering, Fuzzy C Means Clustering
18.03.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises.
23.03.2020	Monday	Lecture		**Ensemble methods:** Decision trees; Bagging and pasting; Random forests; Gradient boosting machines.
25.03.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Home Work 4**
Midterm Exam II (2 hours)				

30.03.2020	Monday	Lecture	Deep Learning	The Kalman filter, Nonlinear filtering, and Markov Chain Monte Carlo
01.04.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Feedback on Home Work 4**
06.04.2020	Monday	Lecture		Neural Networks - Basic Mathematics used for Neural Networks Algorithms, Perceptron
08.04.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises.
13.04.2020	Monday	Lecture		Neural Networks, multi layer neural networks, feed forward and back progpagation learning algorithm
15.04.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises. **Home Work 5**
20.04.2020	Monday	Holiday		**Orthodox Monday**
22.04.2020	Wednesday	Lecture		**Basics of Reinforcement Learning**: Introduction, Examples, Elements of Reinforcement Learning, Limitations and Scope, Tic-Tac-Toe (Reinforcement Learning: An Introduction second edition, Richard S. Sutton and Andrew G.Barto pp 1-13) **Feedback on Home Work 5**
27.04.2020	Monday	Lecture		Deep Learning for Computer Vision pp 119-178 (Francois-Chollet-Deep-Learning-with-Python 2017)
29.04.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises.
04.05.2020	Monday	Lecture		Deep Learning for Text Sequences Vision pp 178-233 (Francois-Chollet-Deep-Learning-with-Python 2017)
06.05.2020	Wednesday	Workshop		Practical application using Python in Jupyter Notebook. Examples and exercises.
Final Exam (2 hours)				

There will be excercises at the end of each Lecture - solutions of these excersises will be discussed on workshop, which will follow the lecture
At the end of each topic there will be homework - in total there will be 5 homeworks - in total there will be **30 points**, each homework will be evaluated maximum by **6 points**
Midterm Exam I - Applied Math - maximum **20 points**
Midterm Exam II - Machine Learning - maximum **20 points**
Final Exam - Deep Learning - **30 Points**
Total - 100 Points