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 №1	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;
22.01.2020	Wednesday	Seminar №1		Practical application using Python in Jupyter Notebook. Examples and exercises.
27.01.2020	Monday	Lecture №2		**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); Principal Component Analysis (PCA);Machin Learning.
29.01.2020	Wednesday	Seminar №2		Practical application using Python in Jupyter Notebook. **Dimension reduction using PCA.** **Homework №1.**
03.02.2020	Monday	Lecture №3		**Probability:** Probability versus statistics; Sigma-algebra; Mesure space; Probability; Independent events; Conditional probability; Bayes' theorem; Random variable; Expected value, Variance; Covariance; Covergence of random variables; Law of large numbers; Central limit theorem. **Information Theory:** Measure of information content; Entropy; Cross-entropy; Kullback-Leibler (KL) divergence.
05.02.2020	Wednesday	Seminar №3		Practical application using Python in Jupyter Notebook. Examples and exercises. **Naïve Bayes Classifier.**
10.02.2020	Monday	Lecture №4		**Numerical Computation:** Basics of order theory; Normed vector spaces; Matrix norms; Metric spaces; Basics of topology; Sequences and limits; Limits of functions; Continuous functions; Derivatives; Gradient; Extrema; Gradient descent method; Newton's method; Automatic differentiation (AD);
12.02.2020	Wednesday	Seminar №4		Practical application using Python in Jupyter Notebook. Examples and exercises. **Root Finding**; **Gradient Descent**; **Feedback on Homework №1; Homework №2.**
Midterm Exam I (2 hours)				

17.02.2020	Monday	Lecture №5	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	Seminar №5		Practical application using Python in Jupyter Notebook. Examples and exercises.
24.02.2020	Monday	Lecture №6		**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	Seminar №6		Practical application using Python in Jupyter Notebook. Examples and exercises.
02.03.2020	Monday	Lecture №7		**Probabilistic modeling:** Logistic regression; Training and cost function; Naive Bayes algorithm.
04.03.2020	Wednesday	Seminar №7		Practical application using Python in Jupyter Notebook. Examples and exercises. **Feedback on Homework №2; Homework №3.**
09.03.2020	Monday	Lecture №8		**Kernel methods:** Decision boundaries; Maximum margin classifiers; Support vector machine (SVM).
11.03.2020	Wednesday	Seminar №8		Practical application using Python in Jupyter Notebook. Examples and exercises.
16.03.2020	Monday	Lecture №9		**Unsupervised Learning:** Clustering algorithms,K Means Clustering, Fuzzy C Means Clustering
18.03.2020	Wednesday	Seminar №9		Practical application using Python in Jupyter Notebook. Examples and exercises.
23.03.2020	Monday	Lecture №10		**Ensemble methods:** Decision trees; Bagging and pasting; Random forests; Gradient boosting machines.
25.03.2020	Wednesday	Seminar №10		Practical application using Python in Jupyter Notebook. Examples and exercises. **Feedback on Homework №3; Homework №4.**
Midterm Exam II (2 hours)				

30.03.2020	Monday	Lecture №11	Deep Learning	The Kalman filter, Nonlinear filtering, and Markov Chain Monte Carlo
01.04.2020	Wednesday	Seminar №11		Practical application using Python in Jupyter Notebook. Examples and exercises.
06.04.2020	Monday	Lecture №12		Neural Networks - Basic Mathematics used for Neural Networks Algorithms, Perceptron
08.04.2020	Wednesday	Seminar №12		Practical application using Python in Jupyter Notebook. Examples and exercises.
13.04.2020	Monday	Lecture №13		Neural Networks, multi layer neural networks, feed forward and back progpagation learning algorithm
15.04.2020	Wednesday	Seminar №13		Practical application using Python in Jupyter Notebook. Examples and exercises. **Feedback on Homework №3; Homework №5.**
20.04.2020	Monday	Holiday		**Orthodox Monday**
22.04.2020	Wednesday	Lecture №14		**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)
27.04.2020	Monday	Lecture №15		Deep Learning for Computer Vision pp 119-178 (Francois-Chollet-Deep-Learning-with-Python 2017)
29.04.2020	Wednesday	Seminar №14		Practical application using Python in Jupyter Notebook. Examples and exercises.
04.05.2020	Monday	Lecture №16		Deep Learning for Text Sequences Vision pp 178-233 (Francois-Chollet-Deep-Learning-with-Python 2017)
06.05.2020	Wednesday	Seminar №15		Practical application using Python in Jupyter Notebook. Examples and exercises. **Feedback on Homework №5.**
Final Exam (2 hours)				

There will be excercises at the end of each Lecture - solutions of these excersises will be discussed on Seminar, which will follow the lecture
At the end of each topic there will be a homework - each homework will be evaluated maximum by **6 points** - there will be 5 homeworks - maximum **30 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