华中科技大学：建设工程信息管理，课程教学大纲
Information Management in Construction

授课语言：英语

Instructor: Przemyslaw Sekula, Ph.D., University of Maryland, College Park

Class Time: March – June 2022

Course Motivation and Learning Objectives

This course will introduce the learner to the basics of the information processing and management in construction. The course provides both, theoretical and practical skills, but it is oriented practically. The course is based on the certain set of tools – namely Python and corresponding libraries (Pandas, Numpy, Sci-Kit learn). For each tool / library, the general overview of the tool will be provided as well as the information about relative solutions in industry and construction management. Students will explore each information and data processing technique during labs in order to gain the general idea and the practical skills. Then, the skills and concepts will be mastered and evaluated based on graded assignments.

The course comprises two blocks: Data processing and manipulation and Machine Learning for practitioners.

By the end of the first block students will learn how to query, process and manipulate the data using Python / Pandas based solutions and how to process information with charts and visualizations. The second block of the course provides a gentle introduction to Supervised Machine Learning techniques. Students will learn the basics of Machine Learning theory, and how to face data challenges using Machine Learning techniques and Sci-Kit Learn library. The specific objectives of this course include:

- Introduction – Information Management for Managers:
  - The general overview about Information Management in Construction.
  - The meaning behind common AI terminology, including neural networks, machine learning, deep learning, and data science
  - What AI realistically can and cannot do
  - Non-technical introduction to deep learning
- Block 2 – Data processing and manipulation
  - Introduction to Python language. It will cover the basics of Python, and the code writing in Jupyter Notebook environment
  - Using Pandas for data processing
  - Introduction to data visualization
  - Employing data visualization skills and techniques with Pandas, Matplotlib, and Seaborn
- Block 3 – Introduction to Machine Learning – Data Science Perspective
  - The basics of Machine Learning
  - Linear Regression algorithm
  - Sci-Kit Learn Library
  - Overfitting and Underfitting problem
  - How to use Machine Learning algorithms for solving real-life problems in construction

Prerequisites

Open for all graduate students and senior undergraduate students. The basics in programming (any programming language) skill is not required, but it will facilitate the learning process. Also, at least one course in Management and/or Project Management will make the learning process easier.

Materials

All necessary materials will be provided daily. The materials are crucial for preparing for the next lab and graded homework. The majority of the materials comes from optional materials.

Optional materials: These materials are not necessary to finish the course, but they are valuable sources of information and knowledge, if someone wants to explore the field more deeply or skips a class for any reason.

- *AI for everyone, deeplearning.ai, (*https://www.coursera.org/learn/ai-for-everyone/home/info). This is the AI course dedicated for non-technical people, such as company owners, high and mid-level managers and so on. The first block of the presented class is based on this course – it abbreviates selected topics that are covered here. AI for everyone almost fully covers the first block of the presented class (except the Construction specific topics) and reaches far beyond the topics that are described during the "Information Management in Construction" course. It is recommended to everyone interested in working with AI teams or using such teams to transform his/her organization. Chinese subtitles are also available for this course.
- *Introduction to Data Science in Python*, *University of Michigan*, (https://www.coursera.org/learn/python-data-analysis) This course introduces the basics of the python programming environment, including fundamental python programming techniques such as lambdas, reading and manipulating csv files, and the Numpy library. Then, the data manipulation and cleaning techniques using the popular python Pandas data science library are covered. This course exceeds the material covered during classes – it is a good learning resource if one needs a deep introduction into Data Science in Python.
- *Applied Machine Learning in Python, University of Michigan*, (https://www.coursera.org/learn/python-machine-learning). This course covers a brief introduction of Machine Learning theory and explores the Sci-Kit Library as a tool for machine learning tasks. This course exceeds the material covered during classes – it is a good learning resource if one is familiar with machine learning theory, but lacks the programming skills in Python.
- *Machine Learning, Stanford University*, (https://www.coursera.org/learn/machine-learning). This is one of the most famous machine learning online courses. It provides a deep theoretical background and some practical skills and covers all the most popular machine learning approaches and algorithms except deep learning. The course is based on Matlab / Octave software, so it is impossible to use the practical part of the course directly on the classes, but it is the most recommended resource for everyone who wants to have a deep and thorough understanding of Machine Learning theory. The videos for this course can be displayed with Chinese subtitles.

Course Schedule

As this is the online course, the students have flexibility in the pace of learning. The only mandatory terms in this course are the homework deadlines. Although, in order to facilitate the learning process the recommended materials for every week are provided. Students are strongly encouraged to follow the presented schedule, in order to make the learning process smooth and easier.

Class	Type of Learning	Topic	Assignments	Max Points
1-2	Lecture	Information Management in Construction – Introduction AI for Construction Managers – Introduction What is AI What is Machine Learning What is Data Terminology of AI What ML Can Do What is Neural Network	Test 1	20
3-4	Lecture / Lab	Introduction to Python		
5-6	Lecture / Lab	Data processing in Python / Pandas 1		
7-8	Lecture / Lab	Data processing in Python / Pandas 2	Test 2	20
9-10	Lecture / Lab	Machine Learning - Introduction and Linear Regression		
11-12	Lecture / Lab	Machine Learning Techniques and Sci-Kit Learn Library		
13-14	Lab	Employing machine learning for solving real problem in construction	Practical Assignment	60
15-16	Lab	Machine Learning Techniques and Sci-Kit Learn Library		

Assignments

Each topic ends with a test or an assignment and each test/assignment is graded. The grades are crucial for obtaining the final grade.

All tests and assignments must be finished before the course ends (6/15/2021). The dates for the tests are fixed.

Tests should be answered individually by students and sent to teacher in the specific time. Students are allowed to use all the materials (including Internet) but they are forbidden to communicate with other students.

Grading systems

The grading system is based on homework. Students may obtain points for each homework as well as additional points according to the list below. The final grade is computed as the sum of all points. It is necessary to obtain 60 points to pass this course.

- 0-20 points for test 1
- 0-20 points for test 2
- 0-60 points for practical assignment