Machine Learning in Food Economics and Agribusiness

**Instructor**: Prof. Xiaohua YU Ph.D., University of Göttingen

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**Office:** MZG 10.121 **Office Hour:** By Appointment

**Meeting time:** *TBA*

**Meeting Place:** Raum 11.111, Gebaeude MZG/Blauer Turm: Pl.

**Teaching Assistant:** TBA

**Course Description**

**Learning outcome, core skills:**

Machine learning is changing the world from different dimensions, and agricultural and food economics is no exception. In contrast to econometrics of causal analysis, machine learning put more emphasis on prediction and pattern recognition. This course will briefly introduce machine learning algorithms for research of agricultural and food economics. It will help master students to master bask techniques in programing for machine learning with Python and their application in food economics and agribusiness analysis.

**Course Contents:**

This course will introduce basic algorithms in machine learning and apply them to research of agribusiness and food economics. Specifically, we will introduce Python language, and how to use Python to realize plotting, feature engineering, linear regression, logit model, support vector machine, k-nearest neighbor, random forest, k-means clustering, neural network and deep learning (ANN, CNN and RNN).

**Examination:**

Written examination (120 minutes, 70%) and homework assignments ( 30%)

Examination requirements: 1. Understand the machine learning models taught in the class

2. Use python skillfully

**Course Outline**

1, Introduction to Python and its application of machine learning in agricultural economics

2, Data Plotting and visualization

3, Linear regression and feature engineering

4, Logit model and support vector machine

5, k-nearest neighbor and discrimination analysis

6, Classification and random forest

7, Artificial neural network and deep learning (CNN and RNN)

8, Unsupervised learning: k-means clustering, PAM, Principal Component Analysis, and

9, Machine learning with time series data

10, Spatial Data Analysis

**Programming Requirement**

1, Python : <https://www.python.org/>

2, Anaconda: <https://www.anaconda.com/>

3, VScode: <https://code.visualstudio.com/>

**Text books:**

Swamynathan Manohar.2017.Mastering Machine Learning with Python in Six Steps. APress.

Matthes E. , 2022. Python Crash Course, 3rd Edition. No Starch Press, L.A.

Raschka Sebastian, Yuxi (Hayden) Liu, Vahid Mirjalili.2022. Machine Learning with PyTorch and Scikit-Learn. Packet Press. 2022.

**Reference Papers :**

Wang H. , X. Yu (2023) “Carbon Dioxide Emission Typology and Policy Implications: Evidence from Machine Learning”. Forthcoming in China Economic Review.

Maruejols L., L. Hoeschle, X. Yu (2022) Vietnam between economic growth and ethnic divergence: A LASSO examination of income-mediated energy consumption. Energy Economics.

Graskemper V., X. Yu and Jan-Henning Feil (2022) Values of Farmers-Evidence from Germany, Journal of Rural Studies. Vo. 89:13-24.

Wang H., L. Maruejols, and X.Yu (2021) Predicting energy poverty with combinations of remote-sensing and socioeconomic survey data in India: Evidence from machine learning. Energy Economics. Vol. 102,  105510. <https://doi.org/10.1016/j.eneco.2021.105510>

Graskemper V., X. Yu and Jan-Henning Feil (2021). Farmer Typology and Implications for Policy Design – an Unsupervised Machine Learning Approach. Land Use Policy. Volume 103, April 2021, 105328.

**Teaching Method:** Lectures+ Lab Sessions

**Course Credits:** 6

**Teaching Language:** English