Indian Institute of Technology Kanpur

Proposal for a New Course

- 1. Course No: ECO 765A (proposed)
- 2. Course Title: Machine Learning for Economists
- Per Week Lectures: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours: 0 (A) Credits: (3-0-0) 9
 Duration of Course: Full Semester
- Proposing Department/IDP: Economic Sciences
 Other Departments/IDPs which may be interested in the proposed course:
 Computer Science, Electrical Engineering
 Other faculty members who may be interested in teaching the proposed course:
 None
- 5. Proposing Instructor(s): Thirumulanathan D
- 6. Course Description:
 - A) Objectives: To provide an understanding of the use of machine learning based methods to answer economic questions. To emphasize the differences and similarities between the econometric and ML based methods. To enable the students to gain hands-on experience on solving in applying ML schemes to real economic data sets.
 - B) Contents:

No:	Торіс	Details	Number of
			lectures
1.	Introduction to Statistical	Introduction to different learning methods,	6
	Learning	supervised/ unsupervised learning, regression,	
		classification, differences between statistical	
		models and algorithmic learning, introduction	
		to computational tools: R, python	
2.	Supervised Learning: Linear	Linear models for regression: regularized	8
	Models	regression, Lasso, shrinkage methods. Linear	
		models for classification: linear discriminant	
		analysis, logistic regression	
3.	Supervised Learning: Non-	Tree-based methods: regression trees,	8
	linear Models	classification trees, random forests, boosting.	
		Kernels, Support Vector Machine (SVM)	
4.	Deep Learning	Neural networks: Convolutional, recurrent.	6
		Regularization and Stochastic Gradient	
		Descent (SGD)	
5.	Unsupervised Learning	Principal Component Analysis (PCA), matrix	8
		completion, K-means clustering, hierarchical	
		clustering	
6.	Big Data: Natural Language	Bag of words, usage of product-description	6
	Processing	data for demand prediction, related	
		techniques	

C) Prerequisites: A UG level course in (i) probability and statistics, (ii) econometrics.

- D) Short summary: This course aims to introduce machine learning (ML) based methods that are useful in addressing economic issues. The similarities and differences between the econometric toolkit and ML methods is emphasized. New methods at the intersection of econometrics and ML that help us answer economic questions is discussed. In addition, students also gain hands-on experience in applying ML methods on real economic data sets, through software demonstration lectures and programming assignments.
- 7. Recommended books:
 - 1. James, Witten, Hastie, Tibshirani. An Introduction to Statistical Learning, 2013. Available online at https://www-bcf.usc.edu/~gareth/ISL/ISLR
 - 2. Hastie, Tibshirani, and Friedman. The Elements of Statistical Learning. Available online at https://web.stanford.edu/ hastie/Papers/ESLII.pdf
 - 3. Athey, Susan. "The impact of machine learning on economics." The economics of artificial intelligence: An agenda. University of Chicago Press, 2018.
 - 4. Venables, Smith, and the R Core Team. An Introduction to R. Available online at https://cran.r-project.org/doc/manuals/R-intro.pdf
 - 5. Varian. Big Data: New Tricks for Econometrics. Journal of Economic Perspectives, 3-27.

Dated: 16.09.2021

Proposer: Thirumulanathan D

Dated: _____

DPGC Convener:_____

The course is approved / not approved

Chairperson, SPGC Dated: _____