COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF INFORMATION SCIENCES & TECHNOLOGY		
ACADEMIC UNIT	DEPARTMENT OF STATISTICS		
LEVEL OF STUDIES	1st Cycle (UNDERGRADUATE)		
COURSE CODE	**6157**	**SEMESTER**	**7th**
COURSE TITLE	**STSP: Methodological Tools of Machine Learning**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	7
Workshops		
Labs	2	

COURSE TYPE	Elective
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://www.dept.aueb.gr/en/stat/content/special-topics-statistics-and-probability-stsp-methodological-tools-machine-learning-7

(2) LEARNING OUTCOMES

Learning outcomes
Students will be able to: • Deeply understand the functions of fundamental methodological machine learning tools, both analytical and computational • Apply those tools to study real problems • Integrate them into developing new techniques
General Competences
Analysis and composition of data and information with the use of novel technologies Adaptation to new situations Decision making Personal exercise Group exercise Exercise in an interdisciplinary field Production of novel research ideas Development of free, creative, and inductive thinking

(3) SYLLABUS

The course focuses on methodological tools of machine learning, such as:

- Reproducing kernel Hilbert spaces and applications
- Manifold learning, data geometry and applications
- Universal approximation theorems and applications to deep learning
- Probability Theory in high dimensions
- Gaussian processes and applications to machine learning
- Familiarization with Python

No prerequisites are formally required, however
basic knowledge of Linear Algebra, Calculus, Probability, Statistical Inference, and Stochastic processes will be useful

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Eclass Email Use of Computer
TEACHING METHODS	

Activity	***Semester workload***
Lectures	52 hours
Study & Analysis of the Bibliography	38 hours
Exercise/Project	10 hours
Course total	***100 hours***

STUDENT PERFORMANCE EVALUATION	Project with presentation and/or final exam.

(5) ATTACHED BIBLIOGRAPHY

- Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
- Calin, Ovidiu. Deep learning architectures. New York City: Springer International Publishing, 2020 Ch. 9
- Hofmann, Thomas, Bernhard Schölkopf, and Alexander J. Smola. "A tutorial review of rkhs methods in machine learning." Technical Report (2005).
- Higham, Catherine F., and Desmond J. Higham. "Deep learning: An introduction for applied mathematicians." Siam review 61.4 (2019): 860-891.

- Professors' notes