Subject programme

1. Subject name / subject module: **Machine learning**
2. Lecture language: **English**
3. The location of the subject in study plans:
   - Area or areas of the studies: **Computer Control Systems Engineering**
   - Degree of the studies: **2nd degree studies**
   - Field or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
   - The Institute / Another unit: **Institute of Informatics and Mechatronics**
   - The person responsible for the subject: **Ocetkiewicz Tomasz, mgr inż.**
   - People cooperating in the development of the programme of the subject:
5. The number of hours and forms of teaching for individual study system and the evaluation method:

Teaching activities with the tutor													Total
Mode of study	Form of classes												
		SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies				33	42	3							**3**
Part-time studies													
Credit rigor				Graded assigment									

6. Student workload – ECTS credits balance:
   1 ECTS credit corresponds to 25-30 hours of student work needed to achieve the expected learning outcomes including the student's own work

Activity (please specify relevant work for the subject)	**Hourly student workload (full-time studies/part-time studies)**
Participation in lectures	-
Participation in laboratory classes	33
Preparation to laboratory classes	15
Preparation of homeworks	10
Independent study of the subject	40
Preparation to a final test	5
Participation in an exam / graded assignment	2
Total student workload (TSW)	75
ECTS credits	3
* Student's workload related to practical forms	75
Student's workload in classes requiring direct participation of academic teachers	33

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:
   - Recommended admission requirements – none.
   - Recommended duration of the subject is taken from the course plan.
8. Specific learning outcomes – knowledge, skills and social competence:

Specific learning outcomes for the subject		Form	Teaching method	Methods for testing of (checking, assessing) learning outcomes
Outcome symbol	Outcome description			
Knowledge				
K_W02	**A student possesses sufficient knowledge of automation, electronics, and electrical engineering, necessary to understand machine learning and its relation to data science and artificial intelligence, and is also able to apply this knowledge in practice through the use of ML to solve tasks in the field of mechatronics.**	**Laboratory work**	**Inquiry methods**	**Final test, Student learning activities**
K_W07	**A student possesses sufficient knowledge in the field of technical informatics, including advanced issues concerning AI algorithms for automation systems and electronic devices, and to apply this knowledge in practice.**			
Skills				
K_U02	**A student is able to use information and communication technologies (ICT) for applying machine learning to data analytics.**	**Laboratory work**	**Inquiry methods**	**Final test, Student learning activities**

9. Assessment rules / criteria for each form of education and individual grades:

Activity	Grades	Calculation	To final
Final test	Bdb (5)	5 * 50%	2,5
Classroom activities	db, dst, bdb (4, 3, 5)	arithmetic mean (4,3,5) * 20%	0,8
Homeworks	ndst, bdb, dst (2, 5, 3)	arithmetic mean (2,5,3) * 20%	0,67
Classes attendence	> 75%	(80% * 5) * 10%	0,4

0 – 3.00	ndst	**4.01 – 4.50**	db
3.01 – 3.50	dst	**4.51 – 4.7**	db+
3.51 – 4.00	dst+	**4.71 – 5.0**	bdb

10. The learning contents with the form of the class activities on which they are carried out

(Laboratory work)

Machine learning Fundamentals of Machine Learning: typical applications, supervised and unsupervised learning, Python libraries for machine learning. Regression: linear regression, non-linear regression, model evaluation methods. Classification: K-nearest neighbour, decision trees, logistic regression, support vector machines, model evaluation. Unsupervised Learning: K-means clustering in machine learning, hierarchical cluster analysis, density-based clustering. Introduction to recommender systems: content-based recommender systems, collaborative filtering.

11. Required teaching aids:

a. Laboratory classes - specialist laboratory.

12. Literature:

a. Basic literature:

1. Miroslav Kubat; An Introduction to Machine Learning; ISBN 978-3-319-63913-0; Springer, Cham 2017

2. Danish Haroon; Python Machine Learning Case Studies; ISBN 978-1-4842-2823-4; Apress, Berkeley, CA 2017

b. Supplementary literature:

1. Mariette Awad, Rahul Khanna; Efficient Learning Machines; ISBN 978-1-4302-5989-3; CC BY-NC-ND 2015

2. Michael Paluszek, Stephanie Thomas; MATLAB Machine Learning; ISBN 978-1-4842-2250-8; Apress, Berkeley, CA 2017

3. Achim Zielesny; From Curve Fitting to Machine Learning; ISBN 978-3-319-32545-3; Springer, Cham 2016

c. Internet sources:

1. Google Colaboratory - https://colab.research.google.com/notebooks/welcome.ipynb#scrollTo=P-H6Lw1vyNNd

2. Python Challenge - http://www.pythonchallenge.com/
3. Spyder - https://www.spyder-ide.org/
4. Python Package Index - https://pypi.org/
5. Machine Learning - https://www.w3schools.com/python/python_ml_getting_started.asp
6. Python Machine Learning Tutorials - https://realpython.com/tutorials/machine-learning/
7. Machine Learning in Python - https://scikit-learn.org/stable/
8. Tensor Flow - https://www.tensorflow.org/
9. Adruino Tensor Flow - https://github.com/arduino/ArduinoTensorFlowLiteTutorials

13. Available educational materials divided into forms of class activities (Author's compilation of didactic materials, e-learning materials, etc.)

14. Teachers implementing particular forms of education

Form of education	Name and surname
1. Lecture	
2. Laboratory classes	Ocetkiewicz Tomasz, mgr inż.
3. Training	
4. Project classes	
5. Workshop classes	
6. Simulation game	
7. Language classes	