1. Course title: MACHINE LEARNING, Classifiers
2. Course code ML_C


4. Level of studies: MSc programme

5. Mode of studies: intramural studies

6. Field of study: CONTROL, ELECTRONIC AND INFORMATION ENGINEERING (MACRO) (FACULTY SYMBOL) RAU-2

7. Profile of studies: ACADEMIC

8. Programme: DATA SCIENCE

9. Semester: 1

10. Faculty teaching the course: Faculty of Automatic Control, Electronics and Computer Science

11. Course instructor: Prof. dr hab. inż. Krzysztof Fujarewicz

12. Course classification: common courses

13. Course status: compulsory/ elective

14. Language of instruction: English


16. Course objectives: The aim of the course is making students familiar with problem and methods related to supervised and unsupervised classification methods. The contents of the course are presented in the aspect of wide spectrum of applications, in particular in engineering, automatic control, electronics and information technologies.

17. Description of learning outcomes:

<table>
<thead>
<tr>
<th>Nr</th>
<th>Learning outcomes description</th>
<th>Method of assessment</th>
<th>Teaching methods</th>
<th>Learning outcomes reference code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Student understands the notion of classification problem. Understands applications of classification in engineering, automatic control, electronics, informatics.</td>
<td>Credit</td>
<td>Lecture</td>
<td>K2A_W13, K2A_W14</td>
</tr>
<tr>
<td>2.</td>
<td>Student distinguishes between supervised and unsupervised classification problems.</td>
<td>Credit</td>
<td>Lecture</td>
<td>K2A_W03, K2A_W04</td>
</tr>
<tr>
<td>3.</td>
<td>Student is able to construct, in scientific programming environments, all major variants of classifiers.</td>
<td>Laboratory tasks</td>
<td>Laboratory</td>
<td>K2A_U16, K2A_U20, K2A_U23</td>
</tr>
<tr>
<td>4.</td>
<td>Student has orientation in existing tools for classification.</td>
<td>Credit</td>
<td>Laboratory</td>
<td>K2A_U11, K2A_U12</td>
</tr>
<tr>
<td>5.</td>
<td>Student is able to use existing tools for classification.</td>
<td>Laboratory tasks</td>
<td>Lecture</td>
<td>K2A_U11, K2A_U12</td>
</tr>
<tr>
<td>6.</td>
<td>Student understands the problem of classifiers validation and understands the phenomenon of information leak.</td>
<td>Credit</td>
<td>Lecture</td>
<td>K2A_U01, K2A_U02, K2A_U03, K2A_U04, K2A_K05, K2A_K06</td>
</tr>
<tr>
<td>7.</td>
<td>Student is able to validate classifiers.</td>
<td>Laboratory tasks</td>
<td>Laboratory</td>
<td>K2A_U01, K2A_U04, K2A_K06</td>
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<tr>
<td>8.</td>
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<td>9.</td>
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</tbody>
</table>

18. **Teaching modes and hours**

   Lecture 30 / BA/MA Seminar / Class / Project / Laboratory 30

19. **Syllabus description:**

   **Lecture:**
   1. Introductory information. Supervised and unsupervised classifiers. Applications of classifiers in engineering, automatic control, electronics, information technologies and biocybernetics.
   2. Supervised classification algorithms. Linear discriminant classifiers, neural networks, support vector machines, k-nearest neighbor classifiers.
   5. Unsupervised algorithms and dimensionality reduction.

   **Laboratory:**
   1. Supervised classification algorithms I.
   2. Supervised classification algorithms II.
   3. Unsupervised classification algorithms I.
   4. Unsupervised classification algorithms II.
   5. Principles of validation I.
   6. Principles of validation II.

20. **Examination:** semester: NO

21. **Primary sources:**
   T. Hastie, R. Tibshirani, J. Friedman, (2008), The elements of statistical learning, Springer

22. **Secondary sources:**
23. Total workload required to achieve learning outcomes

<table>
<thead>
<tr>
<th>Lp.</th>
<th>Teaching mode</th>
<th>Contact hours / Student workload hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>30/30</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>/</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>30/30</td>
</tr>
<tr>
<td>4</td>
<td>Project</td>
<td>/</td>
</tr>
<tr>
<td>5</td>
<td>BA/ MA Seminar</td>
<td>/</td>
</tr>
<tr>
<td>6</td>
<td>Other</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>Total number of hours</td>
<td>60/60</td>
</tr>
</tbody>
</table>

24. Total hours: 120

25. Number of ECTS credits: 3

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 2

26. Comments:

Approved:

(__________________________) (__________________________)
(date, Instructor’s signature) (date, the Director of the Faculty Unit signature)