# Learning of structured data

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| Module no. or code | 10 |
| Module name | Learning of structured data |
| (If applicable) the module's courses | |
| Module content | The module explains the generic analysis and processing of non-vectorial or structured data like graphs, trees, sequential data or alike. We discuss algebraic methods as well as neural network based techniques. The algorithmic part is shown in matlab, numpy/python or by use of other numerical frameworks.<br><br>Exemplary the following key topics are addressed:<br>- Particularities of non-vectorial, compositional and structured data<br>- General proximity measures and implications on mathematical models<br>- Mathematical concepts like information theoretic measures,non-euclidean spaces, local and global embedding approaches<br>- Representation by proximity measures and simple learning methods<br>- Particular algebraic and neural network based Embedding techniques<br>- Evaluation methods for the representation of non-vectorial data<br>- Exemplary implementations and applications |
| Module's learning outcomes | - being able to evaluate and to apply modelling techniques for non-standard data<br>- being able to analyse non-vectorial data and to derive and improve predictive models<br>- knowing how to evaluate and assess respective representation techniques<br>- being able to implement pipelines for non-vectorial data analysis<br>- learn the how-to of proximity based learning<br>- learn how to assess, use and potentially extend the respective frameworks<br>- Students know how to characterize, choose, evaluate, assess and construct practical tools for structured data analysis and respective application fields<br>- learn how to use scientific literature and to understand, derive, implement and potentially extend the presented methods |
| Semester | 2nd semester |
| Duration of module | One semester |

<table>
<tr><td>Frequency</td><td>Winter term only</td></tr>
<tr><td>ECTS-Credits</td><td>5 ECTS</td></tr>
<tr><td>Workload</td><td>
<table>
<tr><th>Workload (Total)</th><th>Attendance time</th><th>Self-Study time (incl. exam preparation)</th></tr>
<tr><td>150 h</td><td>60h</td><td>90h</td></tr>
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<tr><td>Type of module</td><td>Compulsory</td></tr>
<tr><td>Applicability of module</td><td></td></tr>
<tr><td>Conditions for participation</td><td></td></tr>
<tr><td>Responsible for module</td><td>Prof. Dr. Frank-M. Schleif</td></tr>
<tr><td>Lecturer</td><td>Prof. Dr. Frank-M. Schleif</td></tr>
<tr><td>Language of instruction, L. of examination</td><td>English / English</td></tr>
<tr><td>Type of examination;<br>Conditions for the award of CPs</td><td>SoP (G)</td></tr>
<tr><td>Teaching and learning formats of the module</td><td>Lecture with linked exercises,parts of the material is given as scientific articles / handouts and links to exercises. Exercises can be done by teams and solve small practical use cases.</td></tr>
<tr><td>Literature</td><td>- The Dissimilarity Representation for Structural Pattern Recognition, Pekalska & Duin, World Scientific, 2005<br>- Graph Classification And Clustering Based On Vector Space Embedding, Bunke et al., 2010<br>- Kernels For Structured Data, Gartner, 2008<br>- Transfer Learning Through Embedding Spaces, Rostami, 2021<br>- Recent publications on structured learning</td></tr>
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