Study programmes: Astronomy and Astrophysics - PhD Studies

Course name: Big data and sky surveys

Lecturers: Luka Č. Popović, Andjelka Kovačević, Dragana Ilić

Status: Optional

ECTS: 9

Attendance prerequisites: none

Course aims: This course is designed to give students an introduction to methods for getting the most information out of massive data sets using modern machine learning techniques, and to understand the design and operation of large astronomical surveys, for both ground and space-based missions. Students will use several data analysis techniques and apply to available databases. Tools and techniques are practical, providing the foundation for future research and application.

Course outcome: Students will be able to handle and apply the tools and techniques for processing large data in their original research areas, as well as for possible applications in industry.

Course content: Introduction to the specific techniques of collecting data in astronomy using telescopes and satellites. Methods of collecting satellite data for Earth Observation. Design and operation of modern sky surveys. Examples of vast spatial and time-domain surveys. The aims of these observations and their application in research and practical application. Introduction to large databases and their organization and operations. Platforms of large databases and data storage. Big Data example survey in astronomy - Large Survey in Space and Time (LSST). Data mining with SQL and Python. Big data visualization. Practical application (in Python) of dimensional reduction techniques, data mining algorithms, and deep learning techniques to current operational databases (e.g. LSST).

Literature:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems, 2017, O'Reilly Media
2. Jake VanderPlas, Python Data Science Handbook, 2017, O'Reilly Media
3. Statistics, Data Mining, and Machine Learning in Astronomy: A Practical Python Guide for the Analysis of Survey Data by Ivezic, Connolly, VanderPlas, and Gray (ISBN: 9780691151687).

Number of hours: 10	**Lectures: 4**	**Tutorials: 6**

Teaching and learning methods:
Frontal, group, problem solving

Assessment (maximal 100 points)

Course assignments	**points**	**Final exam**	**points**
Lectures	-	Written exam	-
Exercises / Tutorials	60	Oral exam	40
Colloquia	-	Written-oral exam	-
Essay / Project	-		