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Teacher(s)	Nijssen Siegfried ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	<p>An important task in data mining is the discovery of patterns in data. Patterns are recurring structures in data; they can provide interpretable explanations for observations in data, can help to gain a better understanding in the structure of data, can be used to build better models, and can be used to solve other computational tasks (such as the construction of database indexes or data compression). Patterns can be found in many different forms of data, including data from supermarkets, insurance companies, scientific experiments, social networks, software projects, and so on.</p> <p>This course will provide an in-depth introduction to pattern mining. After an introduction to the basics of pattern mining, it will provide an in-depth discussion of a number of advanced pattern mining techniques.</p> <p>Topics that will be discussed are:</p> <ul style="list-style-type: none"> • Categories of pattern mining tasks, including pattern and pattern set mining, supervised and unsupervised pattern mining, dataset types, and pattern scoring functions; • Algorithms for solving different pattern mining tasks; • Data structures for making pattern mining more efficient; • The implementation of pattern mining algorithms; • Mathematical foundations for the different categories of pattern mining tasks; • Complexity classes relevant to pattern mining; • Applications of pattern mining, with a special focus on the application of pattern mining techniques in software engineering.
Aims	<p>Given the learning outcomes of the "Master in Computer Science and Engineering" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes:</p> <ul style="list-style-type: none"> • INFO 1 • INFO 2.1-4 • INFO 4.2-4 • INFO 5.5 • INFO 6.4 <p>Given the learning outcomes of the "Master [120] in Computer Science" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes:</p> <p>1</p> <ul style="list-style-type: none"> • SINF 1.M4, 1.M3 • SINF 2.1-4 • SINF 4.2-4 • SINF 5.5 • SINF 6.4 <p>Students completing this course successfully will be able to</p> <ul style="list-style-type: none"> • Identify the most appropriate pattern mining task for a given data set ; • Explain the advantages and disadvantages of pattern mining algorithms in relation to the problem to be solved ; • Identify appropriate approaches for evaluating the quality of patterns and apply them in various situations ; • Determine the computational complexity of pattern mining problems; • Develop new pattern mining algorithms for new applications. <p>-----</p> <p><i>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".</i></p>
Evaluation methods	25% for the exercises + Written Exam
Teaching methods	<ul style="list-style-type: none"> • Lecture • 3 exercises
Content	<ul style="list-style-type: none"> • Frequent itemset mining: algorithms, data structures; • Constraint-based itemset mining: algorithms, data structures;

	<ul style="list-style-type: none"> • Patterns in sequences, trees, graphs: algorithms, data structures, complexity classes; • Pattern mining in supervised data: scoring functions, algorithms; • Pattern set mining in supervised data: scoring functions, models (decision trees, boosting), algorithms • Pattern set mining in unsupervised data: scoring functions (minimum description length principle, maximum entropy), algorithms • Applications of pattern mining: software repositories, traces, log files, cheminformatics, bioinformatics, industrial applications
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=11034
Bibliography	Charu C. Aggarwal, Jiawei Han (Eds.), Frequent Pattern Mining, Springer 2014 (ISBN: 978-3-319-07820-5) Chapitres de Siegfried Nijssen, Albrecht Zimmermann and Luc De Raedt, Essentials of Pattern Mining.
Faculty or entity in charge	INFO

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Data Science Engineering	DATE2M	5		
Master [120] in Computer Science and Engineering	INFO2M	5		
Master [120] in Computer Science	SINF2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		
Master [120] in data Science: Statistic	DATS2M	5		
Master [120] in data Science: Information technology	DAT12M	5		