Fraunhofer Lab Offer #1: Data Visualisation and Analytics

Description
This course provides participants with a comprehensive and versatile toolbox of data visualisation and analysis methods, which can be transferred to a vast number of applications.

Nowadays many businesses produce and process huge amounts of data, for example in the manufacturing industry by deploying the industrial data space or the medical data space used by the health industry. Resulting data sets allow real-world questions to be answered in a full quantitative stance which used to be hard or even impossible to answer previously: has the internet had country-specific impacts on governance, has government spending on infrastructure had a tangible effect on private mobility and what decisions during a car’s development cycle turn out to be most profitable in the end?

Methods, processes and tools for data analysis and visualization are therefore becoming key ingredients in producing knowledge necessary and instrumental for decision processes.

This lab course teaches methods and tools for analyzing and visualizing data sets. It conveys the technical foundation and gives ample opportunities for practicing data analysis and visualization on real-world data. Innovation of analysis is founded in method orchestration.

At the beginning of the course, the key concepts of data analysis and visualization are taught using the example R as free open-source software package. This part will focus on cluster analysis, the linear regression model and text analysis as well as on creating interactive visualization tools and web applets. Supplementary techniques, which can be covered offhand, include the visualization of maps and graphs, image analysis, combining multiple data sets and more. All of these methods and techniques are practiced using applied real-world data sets.

In the second part, students combine these methods to answer increasingly more complex questions. The heart of this course consists of group specific applied projects, in which existing data sets are analyzed to answer questions from the operative environment.

Apart from acquiring the functional and technical foundations, students will experience the operative potential of data analysis and its application in analysis processes. In effect, this data science course is turning into a living lab.

Requirements
You should have knowledge and skills in programming from past projects and lab courses in prior studies.

Additional information on topic or lab
http://dbis.rwth-aachen.de/cms/teaching/WS2021/VisualAnalytics
Fraunhofer Lab Offer #2: DLT/Blockchain

Description (from past semesters)
By the end of the experience lab on blockchain technology students will have an elaborated understanding of the concept of blockchains for distributed data and transaction management and its potential impact for the digitalization of processes and businesses.

The concept of blockchain is an emerging technology to federate data management across a peer network at first sight. Conventional ACID properties for transaction management in databases are replaced by a new concept of consensus finding. Validity of transactions is assured by a proof of work. Beyond this technological change for assuring transaction correctness, blockchains also allow for institutional changes and new forms of regulation and control (governance) and thus represent a disruptive innovation. Rather than having one centralised institution for assuring the consistency of transactions, e.g. electronic transfer of money, a supervising organisation can be replaced by a peer-to-peer network of processing agents.

Several developments kits and implementation frameworks are already available emphasizing different elements of blockchain technologies, e.g. different approaches of proof of work for correctness assurance of transaction.

In this lab course, students will

- familiarize with the concept of blockchain and its core elements, such as hash coding, different means for consensus finding, synchronization of parallel chains, etc.;
- gain practical experience in deploying an existing tool kit, e.g., Ethereum, Hyperledger, Bigchain DB, or Eris DB;
- implement specific applications by capitalizing on the virtues of blockchain technologies;
- learn how process innovations enabled by blockchain technology impact traditional ways of governance and how new ways of governance can re-shape institutional frameworks;
- design business models and opportunities for new processes in according to new ways of governance.

This lab course continues a series of classes, which deployed blockchains for leveraging machine-to-machine collaboration and the automation of business processes by smart contracts (http://www.fit.fraunhofer.de/en/fb/cscw/blockchain/smart-contracts.html).

This term’s topics will revolve around machine economy and applications in the realms of energy management, production and logistics. By the end of this lab course students will have an extended understanding of the concept of blockchain and its potential impact for the digitalization of processes and businesses.

Requirements
You should have knowledge and skills in programming from past projects and lab courses in prior studies.

Additional information on topic or lab (from past semesters)
http://dbis.rwth-aachen.de/cms/teaching/SS19/Blockchain
Fraunhofer Lab Offer #3: Development and Application of Data Mining and Learning Systems: AI Language and Vision

Description
There are lots of interesting questions covering the procedure from what we look to talking about what we see. In this lab, we do some preliminary practices for cutting-edge interdisciplinary AI research to build a cognitive mind that is able to connect images and languages.

Understanding and explaining cartoons and jokes will help to develop explainable AI and next stage NLP products. We are targeted at developing a creative AI system that can communicate with people in a humorous way. Humor theory suggests the existence of conflict scripts, one common understanding, the other abnormal understanding. Current focused question is: what commonsense knowledge in mind will be activated, when people are amused in a scenario, seeing a cartoon, or reading a joke? Using existing annotated scenery dataset, cartoon dataset, and text jokes, researchers are searching for a structured and unified meaning representation of cartoons and jokes which roots in a missing scenario.

For the safety and the reliability of mobile robots, we are developing novel knowledge representation and reasoning methods in order to theoretically guarantee that mobile robots follow symbolic rules rigorously, instead of to a degree of probability. To this end, a diagnostic dataset, which consists of objects, descriptions, and programmable question-answering collected from real situations, will be developed using Blender. This dataset is targeted as an extension of the CLEVER dataset to contribute cognitively adequate spatial knowledge for safe behavior and natural communication.

In methodology, neither modern Deep-Learning AI nor classic symbolic AI alone may be sufficient, we test possible ways to unify Deep-Learning with symbolic structures.

Topics in the current lab include: word-sense disambiguation, humor analysis, learning spatial commonsense knowledge from texts, constructing geometrical scene for human-machine interaction. Weekly small group zoom meetings are provided. Topics on humor analysis are carried out in an international setting. There is weekly zoom meeting with world-leading humor researchers from Tax A&M and Purdue (USA). New topics will be created to meet the interest of the participants.

Requirements
Participants are expected to have the enthusiasm to try new things. Programming skill of Python is a plus.

Additional information on topic or lab
http://laotzu.bit.uni-bonn.de/