



Year and bachelor projects

Department of Software Engineering



Topics on KSI in general

❖ **software development, software applications, data science**

- ❖ multimedia (search engines), similarity modelling
- ❖ open data
- ❖ graph and multi-modal databases (social networks)
- ❖ recommender systems
- ❖ desktop, web and mobile platforms
- ❖ parallel and high-performance systems

❖ **Bioinformatics**

❖ **HW-related projects (GPU)**

- ❖ custom GPU+CPU cluster

❖ **machine learning techniques** (deep networks, etc.)

Search in video

❖ Development of algorithms for more accurate and faster searching in MMDB

- ❖ interactive search of large video collections
- ❖ image modeling, ranking, visualization
- ❖ participation in international competitions
- ❖ VideoHunter@MFF workshop

Contact: **Jakub Lokoč**

Query result in the selected display

The screenshot displays the SOM HUNTER web interface. On the left, a sidebar contains several controls: a 'Text querying (also temporal)' section with a search bar containing 'mountain' and a 'then...' dropdown; a 'Liked images' section with a 'Likes:' button; a 'Rescoring' section with 'Rescore to Top N' and 'Rescore to SOM' buttons; a 'Display types' section with 'SOM Display', 'Top Scored', and 'Top Scored Context' buttons; and a 'History' section with a timeline showing '5:00:05 PM' and '5:00:11 PM', and an 'ACTIVE' button. Below these is a 'Bookmarks:' section. At the bottom of the sidebar is the 'SOM HUNTER' logo, which features a Viking ship and the text 'SOM HUNTER'. The main area of the interface is a grid of 60 small video thumbnails, each showing a different mountain scene. The thumbnails are arranged in 6 rows and 10 columns. The top row of thumbnails is highlighted with a red border. The text 'Query result in the selected display' is written in red above the grid.

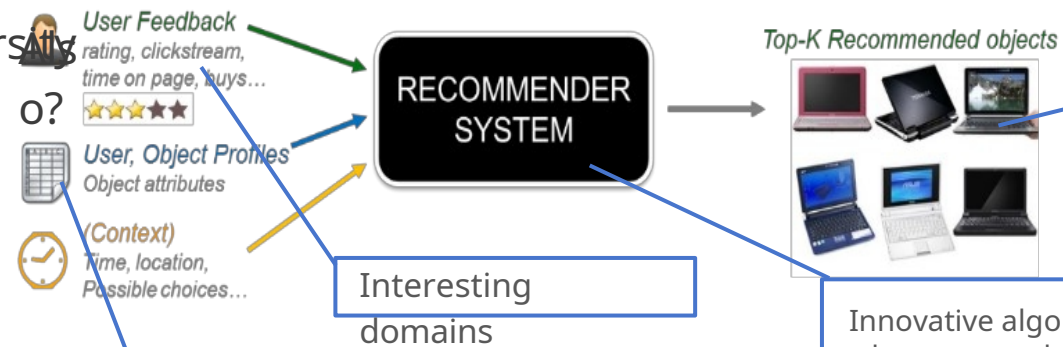
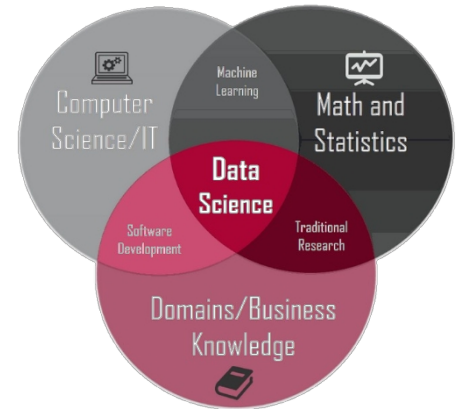
Recommender systems

- ✓ *Interested in data science?*
- ✓ *Do you want to create something practical?*
- ✓ *Do you like to combine knowledge from different disciplines?*

- ❖ Come explore/create recommender systems!
- ❖ NSWI166 (Introduction, ZS 2/1) NDBI021 (Continuation, LS, 2/1)

❖ Examples of year / bachelor / diploma projects

- ❖ Fairness and/or calibration in recommender systems
- ❖ Using audio/video information to recommend films
- ❖ Design of a domain-specific recommender (eco)system
- ❖ How people perceive relevance, diversity
- ❖ Winner of IT SPY 2023
- ❖ Contact **Ladislav Peška**
 - ❖ www.ksi.mff.cuni.cz/~peska/projekty.php



Integration of
different data
sources

Interesting
domains

Top-K Recommended objects

Comparative Analysis
of Off-line vs. On-line
Sequence-awareness
Beyond Accuracy,
Bias...

Innovative algorithms, proportional representation,
long-term added value, group recommendation,
package composition and other challenges

Bioinformatics applications and tools

❖ Web plugins

❖ Visualization of RNA structure

- ❖ To be used in RNACentral
 - ❖ the world's largest repository of information on RNA molecules
- ❖ In collaboration with the European Bioinformatics Institute and Georgia State University

❖ Facelifting tools for protein active site prediction

- ❖ Used by hundreds of users per month

❖ Machine learning in bioinformatics

- ❖ Detection of active sites from protein sequences
- ❖ Classification of faulty layouts of RNA structures

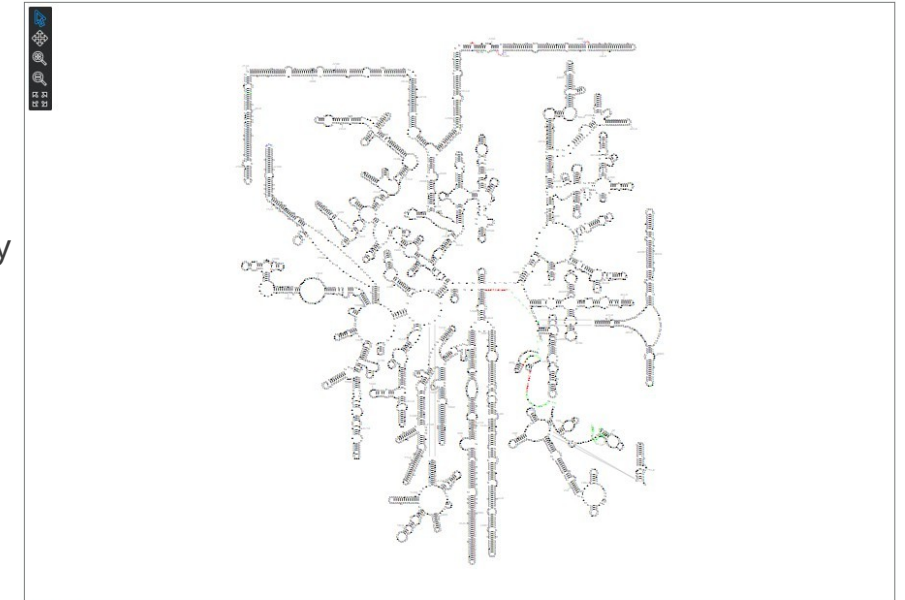
❖ Contact: **David Hoksza**

no prior knowledge of biology is assumed

Secondary structure

Generated by R2DT using the *HS_LSU_3D* template provided by RiboVision. [Learn more](#) →

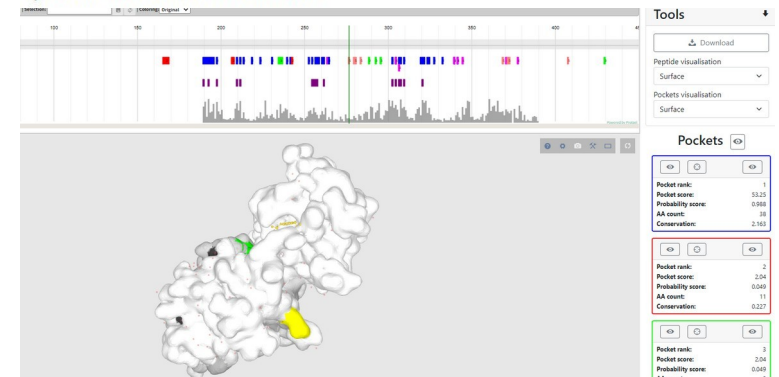
[Toggle colours](#) [Toggle numbers](#) [Save PNG](#) [Save SVG](#) [Copy dot-bracket notation](#)



Colour legend

- Same as the template
- Modified compared to the template. Tip: Hover over green nucleotides for more details
- Inserted nucleotides
- Repositioned compared to the template

Tip: Hover over the nucleotides to see nucleotide numbers



Open data

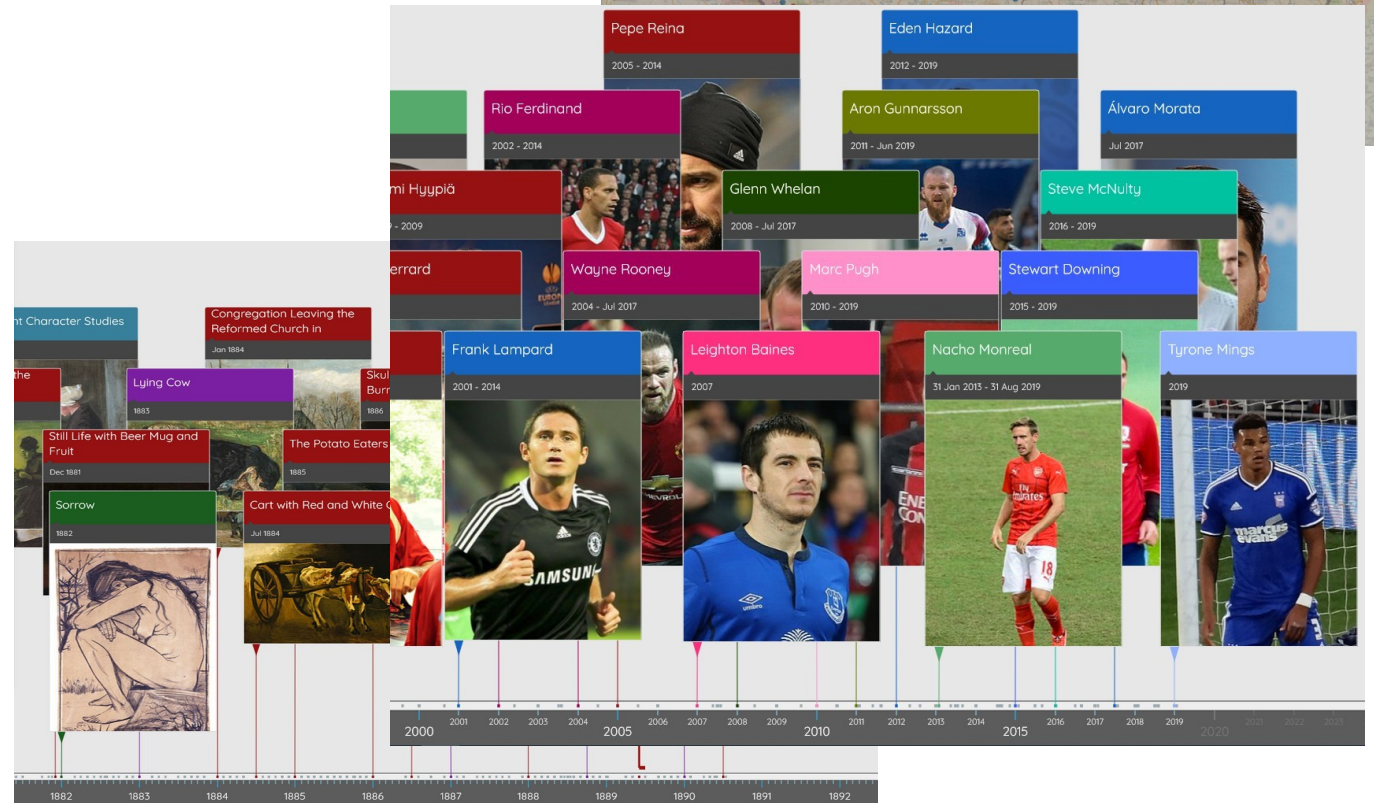
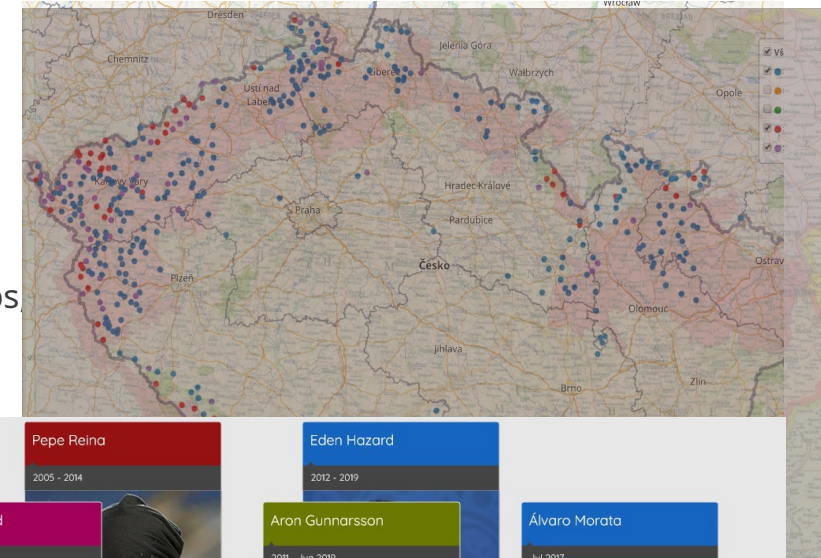
❖ open-source tools for working with open data

- ❖ visualisation of the history of settlement of the Czech Republic
- ❖ applications for teaching history, etc.
 - ❖ events of the world wars, the work of Vincent van Gogh, transfers of footballers between clubs

❖ successful works will be used for

- ❖ <https://data.gov.cz>
 - ❖ official domain for open data of the Czech Republic
- ❖ <https://wikidata.org>
 - ❖ community database used in Wikipedia or Google

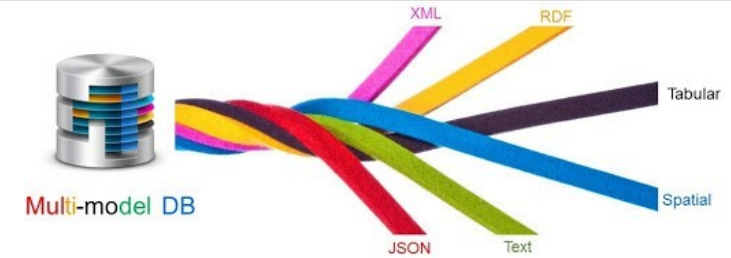
❖ Contact: **Martin Nečaský**



Modern data models and database systems

❖ Popular data models

- ❖ Graph data (social networks), hierarchical data (JSON documents), multi-model data, ...
- ❖ Multi-model data= represented in multiple linked data models
 - ❖ e.g. social network of customers (= graph), their orders (= relational data) and descriptions of ordered products (= JSON documents)



❖ Modern formats and databases

- ❖ Conceptual modelling and design of a multi-model database schema
- ❖ Visualization and querying over multi-model data
- ❖ Visualization and querying over graph data
- ❖ Comparative analysis of selected modern database systems

❖ The specific topic can be arranged according to student preferences

❖ Contact: Irena Holubová

