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Bachelorthesis proposal

Sparked, an intuitive user interface for the
automated machine learning project CODA

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1 Motivation

With the ongoing digitalisation and the generation of big data in most aspects of society, data driven approaches to every day problems become more and more viable. One way to evaluate these large datasets is with a machine learning approach. Machine learning, though powerfull, has its own challenges. Not every machine learning approach is applicable for every problem, not every algorithm will perform in reasonable time on every data, the list goes on.

A lot of intimate knowledge and intuition about machine learning algorithms is needed to select a good approach to your given problem. Knowledge and intuition that is only developed in few experts. Even then, to optimize for a given problem still requires a lot of trial and error, as most of the time the best hyperparameter settings can only be found by trial and error.

To automate this process, DAI-Labor (Distributed Artificial Intelligence) and GT-ARC (German Turkish Advanced Research Center for ICT) have started CODA, a fundamental resarch project in algorithm selection and hyperparameter optimisation. [Siv]

With this project, nicknamed Sparked, we create an interface to the CODA project, allowing machine learning enthusiasts and specialists to use the developed solutions and giving the team an interface to demonstrate CODAs capabilities.

As such we will provide a user interface that is usable in demonstrations and can be used by persons with a background in machine learning without prior training. As such a focus is set on a clean workflow, good user guidance and a visual appealing display.

2 Objective

The overall objective of Sparked is to create a web application and a supporting backend to interface with the CODA backend.

To develop Sparked an architecture has to be chosen. This includes which languages and technologies will be used in the development process.

2.1 Architecture

The architecture has to support several use cases:

- Demonstration startup

It should be easy to spin up a clean Sparked instance with empty databases for demonstration purposes. Sensible defaults should apply, to make such an instance immediately usable even by an untrained individual.

- Configurability

Changing the CODA Backend should be possible without recompile.

- Docker deployment

Sparked has to run in docker containers on a linux system.

Some common characteristics of web applications are not relevant in this project:

- Useraccounts

All Users will operate on the same data. There will not be any useraccounts. Any data uploaded to Sparked is visible to all other users.

- Login

The UI will be open and not contain any login features or any other form of access control.

Coda will run on a separate machine, connected via a Kafka bus system. Kafka access is not part of the Sparked project. An encapsulation library written in Java will be provided.

2.2 Workflows

Sparked contains several workflows:

- Order creation

An order can be created. This includes the selection of all values needed to create an order. classifier, metric, test dataset and validation method with their respective parameters.

After an order is created, it will be split in tasks and put into a queue for processing. This includes persisting them to have a keep them in data on restart.

- Test data

While creating an order, the user may select from a pool of testdata but may also chose to upload their own sets. Uploaded files have to be redirected to CODA to allow usage in the evaluation process.

The data will not be validated in Sparked. Correctly formatted data will be assumed.

- Order overview

View all orders, with their tasks and allows them to be paused or continued if not finished. A Sparked instance will connect to a single backend.

- Order evaluation

Display an evaluation page for order and task results.

It is not possible to access several CODA backends at the same time.

Sparked does not contain any evaluation logic or machine learning support itself. As such it is dependent on the data returned from CODA via Kafka.

2.3 Evaluation

To evaluate the the usability and user interface decissions, a think-aloud interview will be conducted. This method helps to understand the expectations a user has at a given point in a workflow and shows if the user is able to use the application in a successfull manner without prior knowledge of the program or if help is needed.

The results of the think aloud interview will be discussed in this thesis, but not influnece the actual development. Ideally a think aloud interview would be followed by a secondary development block to address the found factors. Instead the results will be collected for possible future projects.

The think aloud interview is not supposed to be a statistical evaluation, the number of participants does not have to be statistically significant.

3 Work packages

The project is roughly separated in 3 parts:

- Evaluating similar solutions
- Architecture
- Development
- Evaluation

3.1 Architecture

- UX Design
- UI Design
- Technology evaluations
 - Database
 - Backend language and technology
 - Frontend language and technology
 - Frontend chart library
- System architecture

3.2 Development

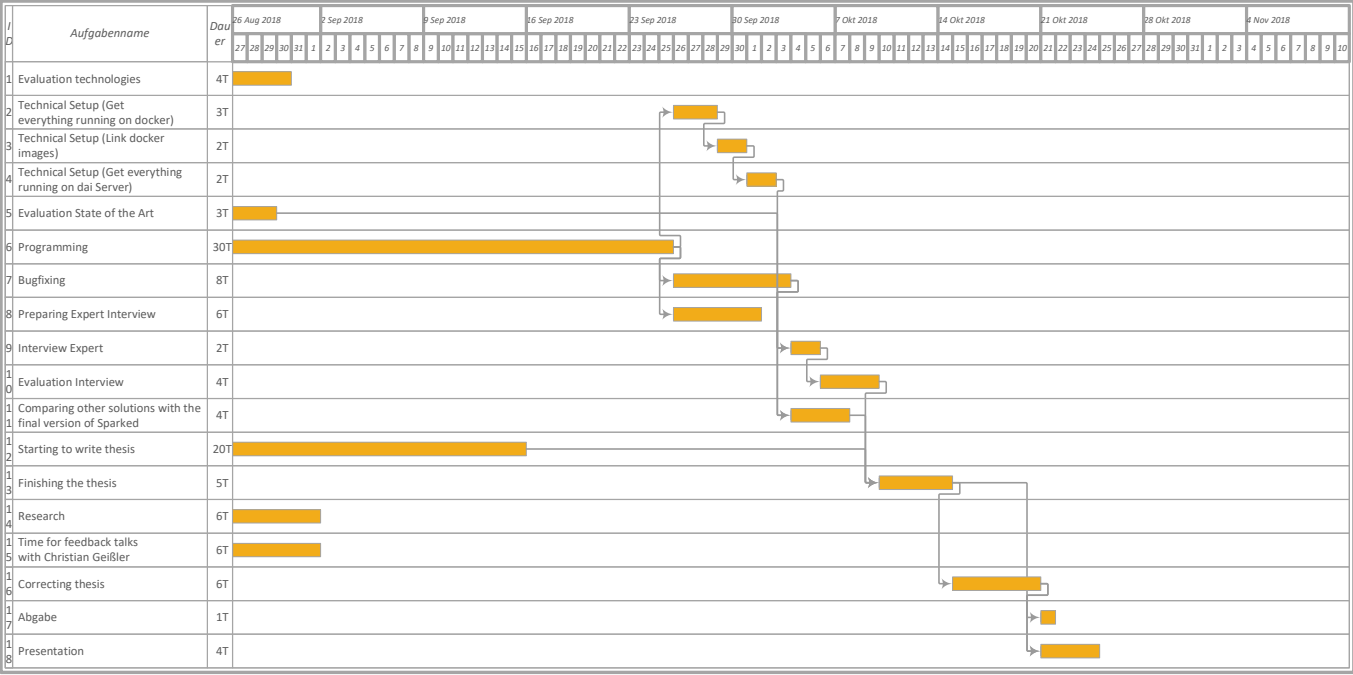
- Basic setup
- Order creation
- Datapersistence: Database access module
- Basic userinterface
- Testdata upload
- Order overview page

- Integrating Kafka access library / CODA connection
- Configuration page
- Order evaluation
- UI optimization
- Bugfixing
- Docker setup
- Final deployment

3.3 Evaluation

- Find test group
- Create interview questionair
- Hold the interview
- Evaluate the statements

Sparked time plan

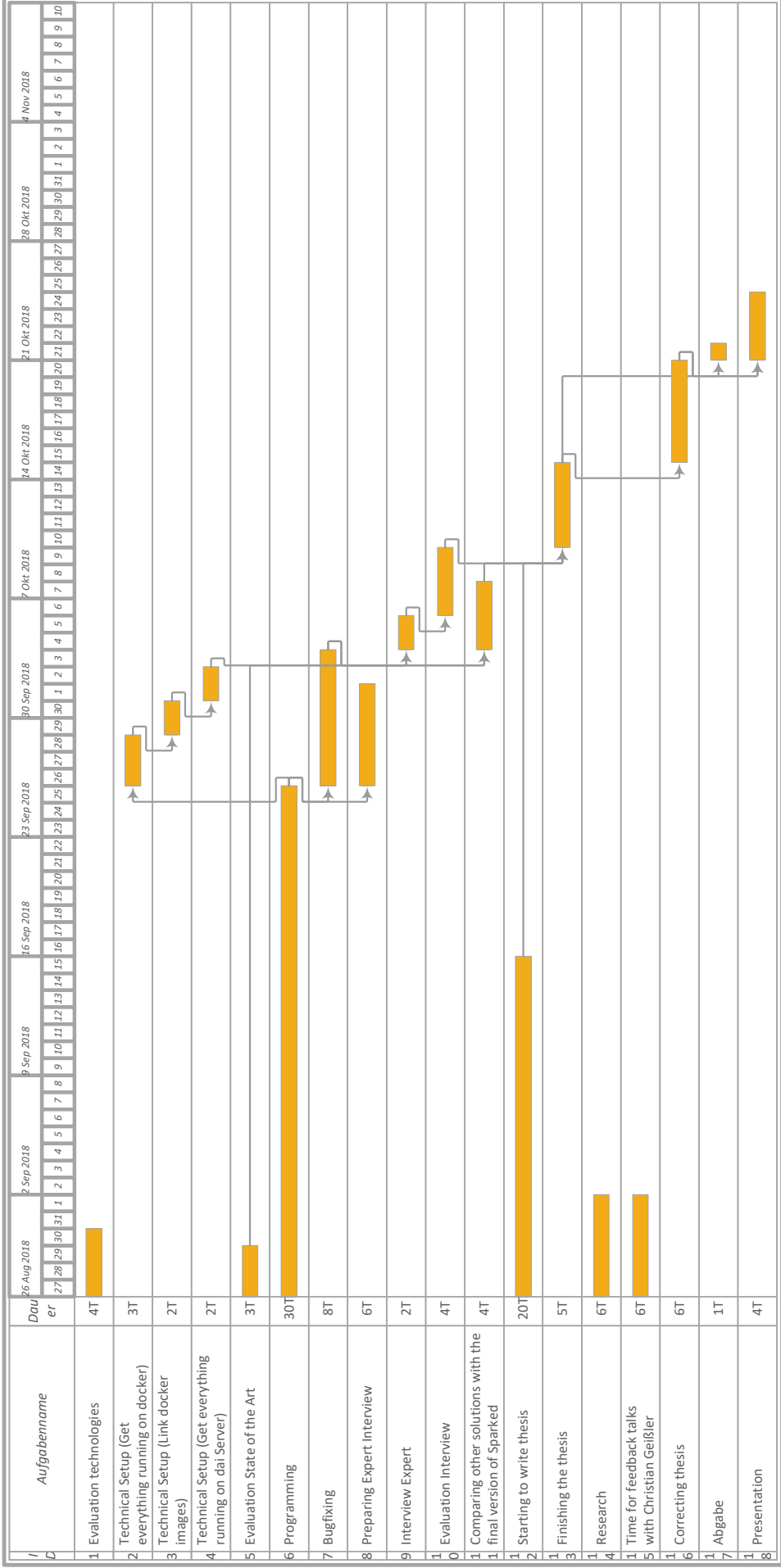


4 Organizational

- Language of this Bachelorthesis is english.
- The thesis will be written with pdf_latex.
- Choosing programming languages and technologies are not defined and part of the development process.
- Supervisors is Christian Geißler
- Evaluators are Prof. Dr. Albayrak and Prof. Kao

5 Appendix

Sparked time plan



Literatur

- [Siv] Dr. Fikret Sivrikaya. *Automatisierung von Machine Learning Workflows, CO-DA Projekt-Steckbrief*. URL: http://www.gt-arc.com/wp-content/uploads/2017/08/Projekt_GT-ARC_CODA_de.pdf.