Themenliste Projektmodul Wirtschaftsinformatik SS23

Implementation and comparison of interpretable machine learning methods

In many cases, complex machine learning models such as boosted trees, deep neural networks or ensemble methods achieve better results than simpler models. However, these procedures have a decisive disadvantage: they are so complex that people can no longer understand how they arrive at their predictions. They are black boxes. To address this problem, a growing body of AI research is concerned with how to make complex models interpretable and understandable ex post. The goal of this project is the implementation and comparison of three state-of-the-art interpretation methods with regard to a self-created, complex machine learning model: Shapley Values, LIME and Counterfactual Explanations. You will use an openly available dataset of your choice.

Literature:

Molnar, C. (2020). Interpretable machine learning. Lulu. com.

Ribeiro, M. T., Singh, S., & Guestrin, C. (2016, August). " Why should i trust you?" Explaining the predictions of any classifier. In Proceedings of the 22nd ACM SIGKDD international conference on knowledge discovery and data mining (pp. 1135-1144).

Wachter, S., Mittelstadt, B., & Russell, C. (2017). Counterfactual explanations without opening the black box: Automated decisions and the GDPR. Harv. JL & Tech., 31, 841.

Štrumbelj, E., & Kononenko, I. (2014). Explaining prediction models and individual predictions with feature contributions. Knowledge and information systems, 41, 647-665.

Comparison of FLUSS vs. rival segmentation algorithm on time series data

The Matrix Profile algorithm 'FLUSS' is one of the most powerful time series segmentation algorithms and can be used to find anomalies and structural breaks in a wide variety of time series data. Unlike statistical approaches, it follows a pragmatic shape-based approach which can be understood intuitively. The goal of this project is to compare the procedures and the performance of FLUSS with another competitive time series segmentation method, emphasizing their respective strengths and weaknesses. Use the following time series repository for your application: The UCR Time Series Classification Archive.

Literature:

Gharghabi, S., Ding, Y., Yeh, C. C. M., Kamgar, K., Ulanova, L., & Keogh, E. (2017). Matrix profile VIII: domain agnostic online semantic segmentation at superhuman performance levels. In 2017 IEEE international conference on data mining (ICDM) (pp. 117-126). IEEE.

Implementation of linear optimization model in the context of production scheduling

During the last years, many production companies faced serious materialization issues, which forced them to optimize their use of available materials. A promising approach in this regard is the use of a linear optimization model which reflects both the production constraints (such as material availability and capacities) and goals of the production company (such as customer satisfaction and revenue generation) in order to find the optimal production plan. The goal of this project is to implement a functioning linear optimization model in python and to evaluate its performance versus a simple approach to production planning, which only takes into account the delivery date promised to the customer. You will use a real-world dataset which will be provided by the chair.

Literature:

Koop, A., & Moock, H. (2018). Lineare Optimierung-eine anwendungsorientierte Einführung in Operations Research. Springer Spektrum.

Automation of invoicing processes in dentistry (together with our praxis partner Dentadox)

In Germany, invoicing and billing processes in the dental field are know-how intensive and require many manual steps due to two different billing systems (public health insurance and private) and numerous complex billing rules. Dentists record treatment in bullet point form, including typos and own abbreviations. The protocol is then translated into a valid invoice, where typically each bullet point is mapped to one or more catalog positions of the GOZ (Gebührenordnung für Zahnärzte) or BEMA (Einheitliche Bewertungsmaßstab für zahnärztliche Leistungen) by billing specialists, and questions or ambiguities are elaborately coordinated with the dentist before the (valid) invoice can be issued. The goal of this project is to foster the automation of dental invoicing processes and enhancing them with AI components. A first work (one student) develops an interactive dashboard that suggests and learns personal abbreviations and typical typos, such that a system can – over time – auto-correct and auto-translate protocols. A second work (another student) applies frequent pattern mining to a set of invoices to determine position that typically go together, where here to goal is to identify whether exceptions from the learned rules (e.g., when position C does not follow from A and B, although it typically does) are explainable by exclusion rules or not).

Literature:

To be announced in the kick-off meeting, together with further information from Dentadox