



HOMER

Achieving Responsible ML
by Human Oriented autoMated machinE
leaRning



MI²DataLab Winter Seminar 2022



Understand and automate the whole process of
how a Data Scientist approaches **data analysis,**
modelling and explainability.



Education



Education



Research



Solutions





Past courses

Case studies (19/20, 20/21, 21/22)

- imputation of missing data
- triplot in Python
- forester BSc thesis
- AutoExpSel BSc thesis

Data Visualization Techniques (20/21, 21/22)

Introduction to Exploratory Data Analysis (20/21, 21/22)

Anna Kozak



Now and future courses

Data Visualization Techniques (22/23)

Introduction to Exploratory Data Analysis (22/23)

Programming and data analysis advanced in R (22/23)

- related to AutoEDA topic

Anna Kozak



Research



Education



Research



Solutions



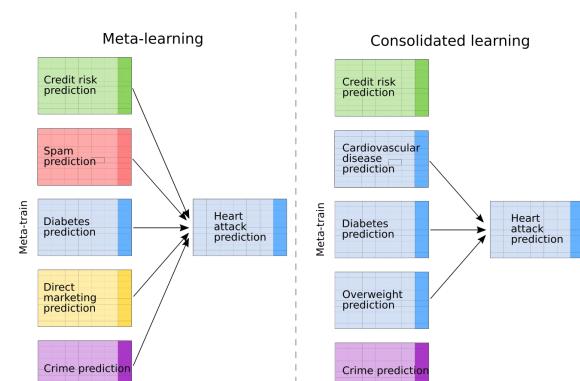


AutoML



AutoML with hyperparameter optimization in an effective way and use of transfer learning techniques

Contact person: Kasia Woźnica

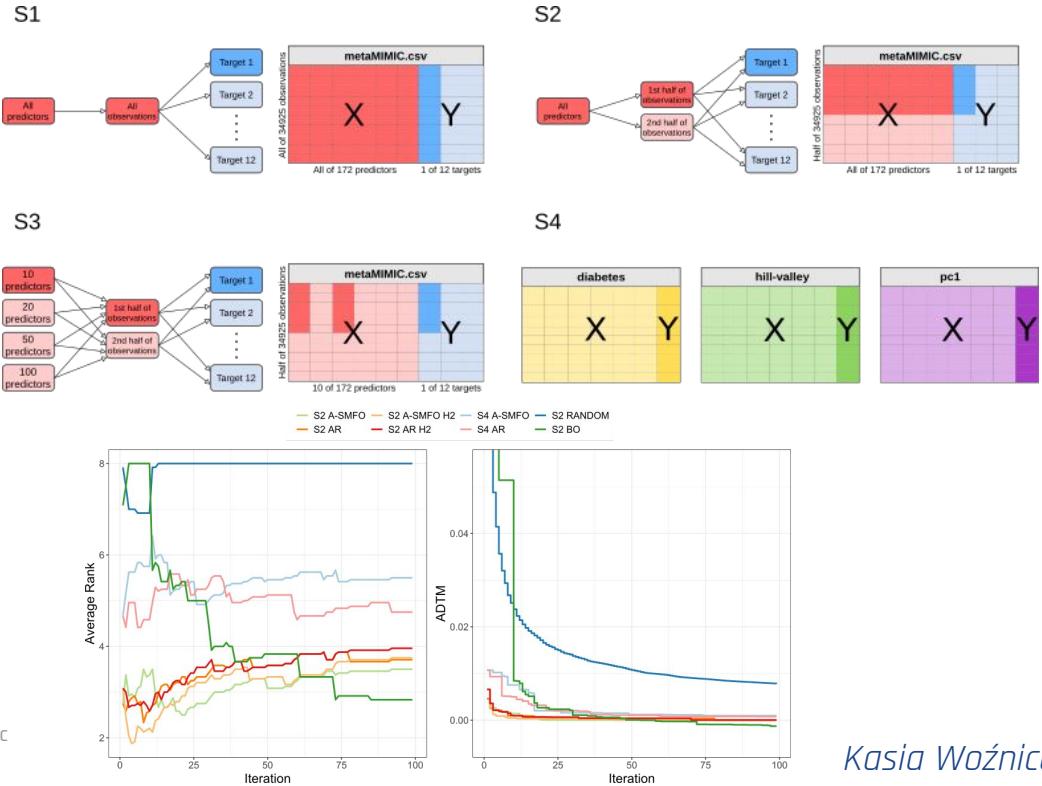


Kasia Woźnica



Consolidated learning and HPO

- metaMIMIC benchmark

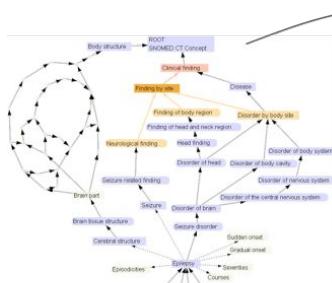


[Woźnica K., Grzyb, M., Trafas, Z. and Biecek, P., 2022. Consolidated learning - a domain-specific model-free optimization strategy with examples for XGBoost and MIMIC-IV.] [\[paper\]](#)

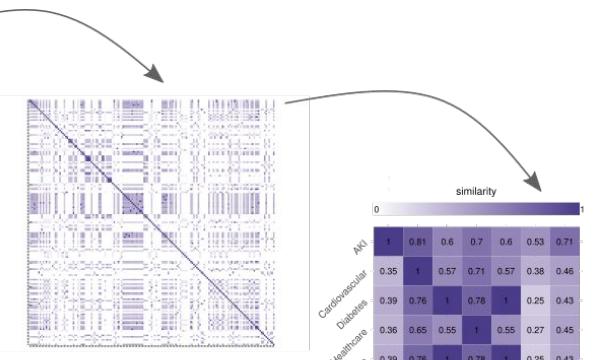
Kasia Woźnica



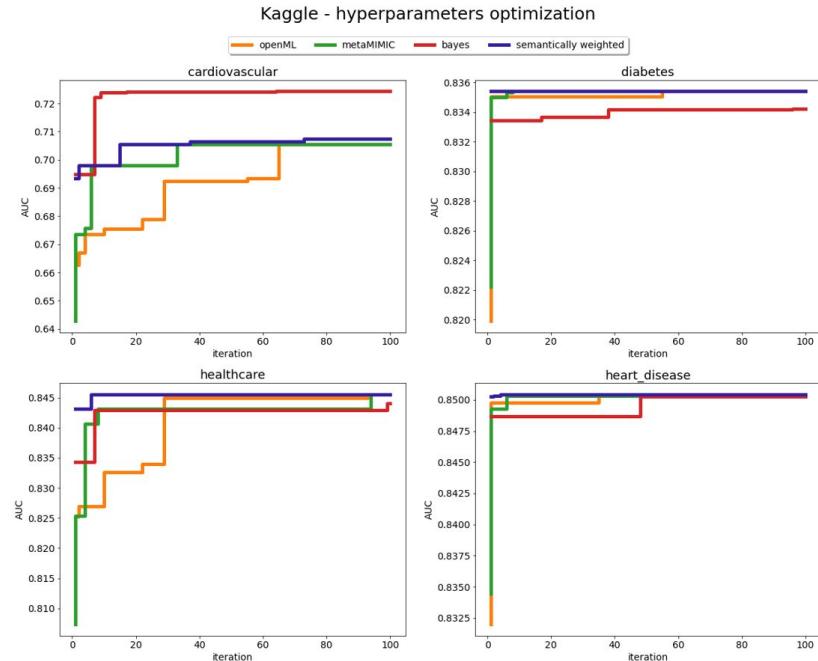
Semantic similarity as extension of consolidated learning



SnoMED CT hierarchy
(visualization)



Similarity between datasets



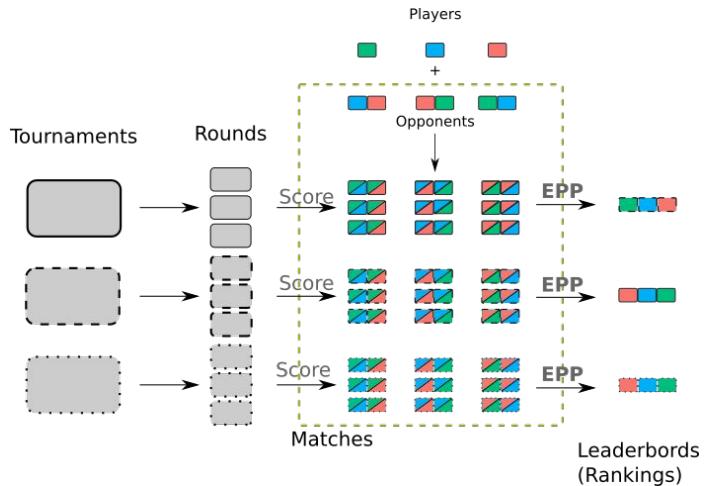
Piotr Wilczyński



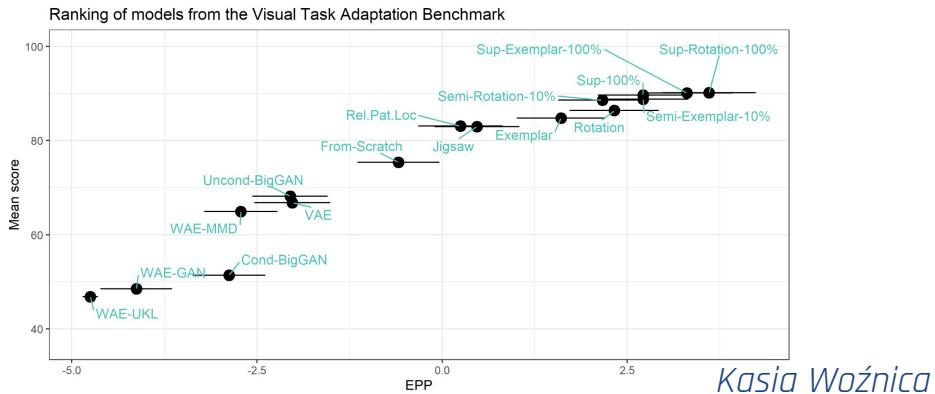


EPP - Elo-based Predictive Power Measure

Idea for future work:



- most (all?) AutoML frameworks build ensembling models
- EPP can be used for per instance model selection taking into account model performance on the entire dataset



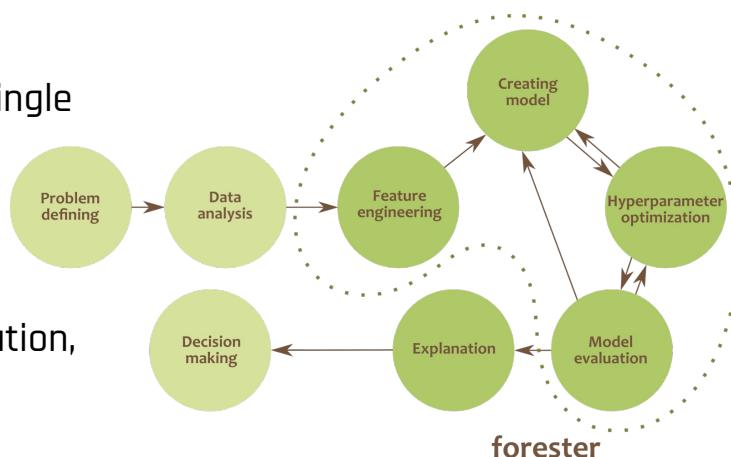


forester - an R package for AutoML

AutoML for Tree-based Models - creating a package - R.
Compatible with DALEX, maybe in the future - auto EDA.

The forester package **wraps up all ML processes** into a single `train()` function, which includes:

- a brief data check report,
- preprocessing,
- training 5 tree-based models with default parameters, random search and Bayesian optimization,
- evaluating and ranked list.



Anna Kozak





Explainable AI



Develop methods for human-oriented model evaluation: explanation, fairness etc.

Contact person: Hubert Baniecki

Hot topics in XAI (2022):

1. Evaluating explanations – trustworthy
2. Attacking explanations – adversarial & security
3. Explainability and fairness for survival analysis – responsibility

*On a mission to **responsibly** build
machine learning predictive models*



dalex.drwhy.ai



1,116

Hubert Baniecki





Evaluating explanations

1. **LIMEcraft** (Machine Learning, 2022)
2. **Interactive Explanatory Model Analysis** (in review) to be presented at ML in PL 2022
3. **Kandinsky Patterns → AES (Automated Explanation Selection)**
 - a. Lessons learned from the summer internship:
 - i. KP data is interesting but (for now) hard to utilize
 - ii. Concept Relevance Propagation (CRP) <https://arxiv.org/abs/2206.03208>
 - b. We arrived at: "Automated explanation selection for convolutional neural networks" BSc thesis by A. Kaczmarek, M. Stączek, P. Wojciechowski
KW: Quantus, lazypredict, modelStudio, evaluation, automation, reporting

Hubert Baniecki





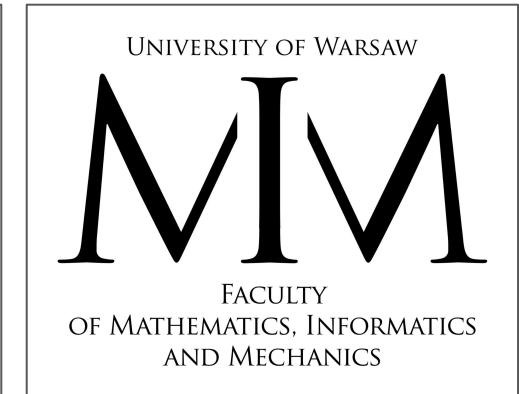
HOMER → ARES (Attack-Resistant Explanations toward Secure AI)

NCN PRELUDIUM BIS 2022-2026

Originates from ideas presented at
AAAI 2022 and ECML PKDD 2022.



1. Develop adversarial attacks on state-of-the-art explanations to investigate their vulnerabilities.
2. Introduce robust explanations that are stable against manipulation and intuitive to evaluate.



Hubert Baniecki



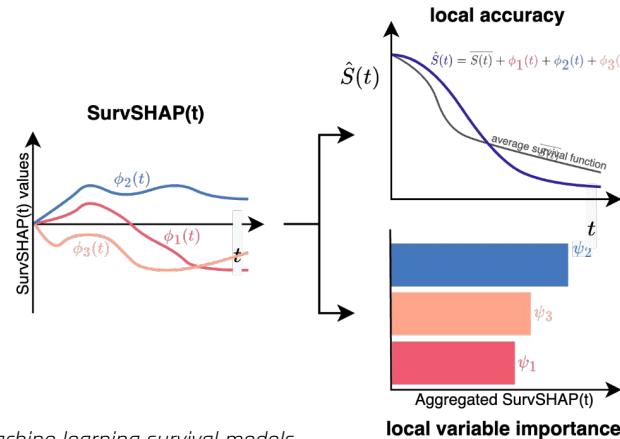
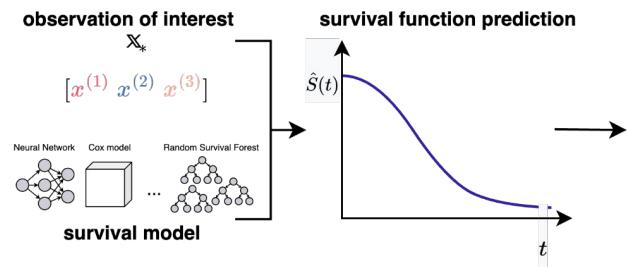
Explainable Survival Analysis: SurvSHAP(t)



1. detecting time-dependent **variable effects**
2. determining the **local variable importance** via aggregating

What?

1. SurvSHAP(t) method with Python implementation
2. paper describing some functionalities (local explanations); submitted to KBS



M. Krzyński, M. Spytek, H. Baniecki, P. Biecek, *SurvSHAP(t): Time-dependent explanations of machine learning survival models*

Mateusz Krzyński





Explainable Survival Analysis: survex



Adding **explanations as another step** for working with survival models.

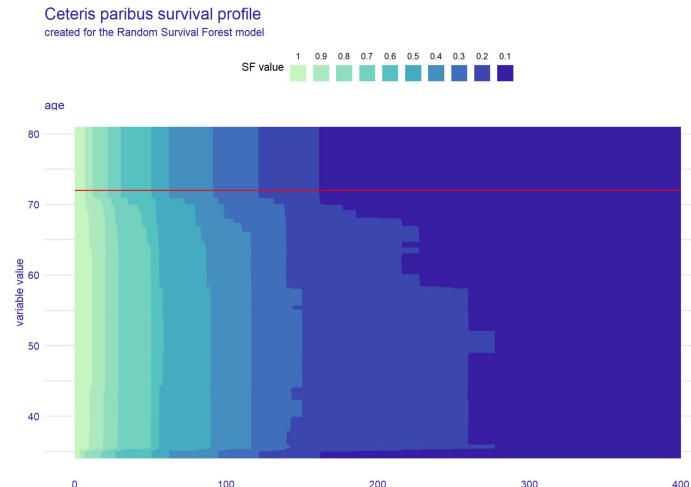


Why?

1. sizable user base of the existing but unmaintained *survxai* R package
2. lack of implementations of survival-specific explanations

What?

1. **survex R package**
2. **extensions of well-known methods** for models with functional output, implementations of specific survival methods (SurvSHAP(t), SurvLIME)



Mikołaj Spytek





Explainable Survival Analysis: ideas

1. **further development** of survex package (e.g., implementation of aggregating time-dependent explanations)
2. **paper** about survex package
3. **propagating concept** of explaining survival models
 - ◆ in medical environment:
 - **experiments** on xLungs data
 - checking the **trustworthiness** of models (creating *checklist*)
 - building new models in **responsible way** - generating medical knowledge
 - ◆ in software/statistician environment:
 - cooperation with research group at LMU - presentation at their seminar

Mateusz Krzyżiński





xG - expected goal models with XAI

EXPLAINABLE EXPECTED GOAL MODELS FOR PERFORMANCE ANALYSIS IN FOOTBALL ANALYTICS

A PREPRINT

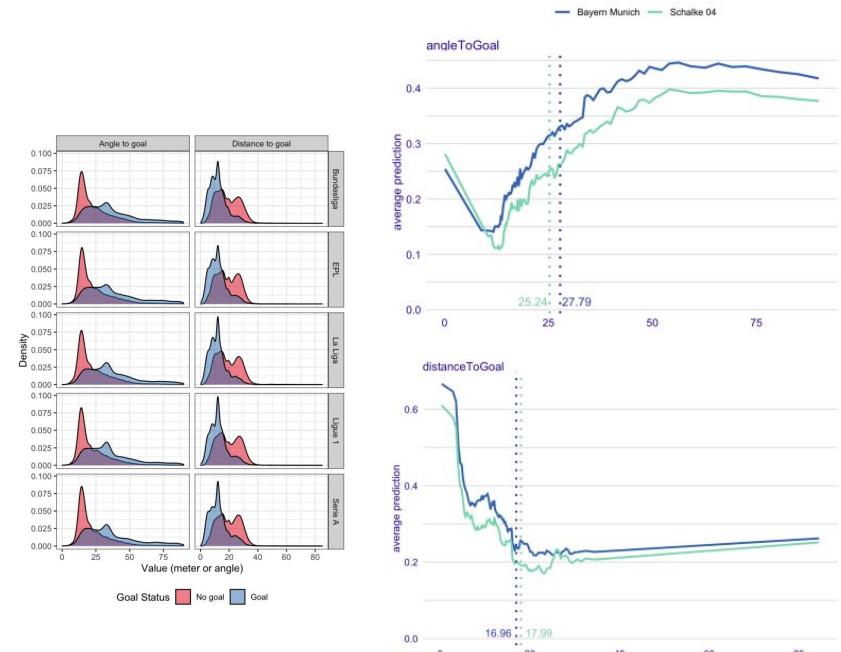
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Przemysław Biecek





Conferences



It is worth going out with your research:

- feedback
- appreciation of the idea gives motivation for further work
- we learn to talk about our results to people who have never heard of them

Kasia Woźnica



Conferences

1. consulting idea and research progress on the topic-specific workshops - COSEAL
2. presenting peer-reviewed results in the international conferences - ECML PKDD
3. presenting its findings to the local community - MLinPL

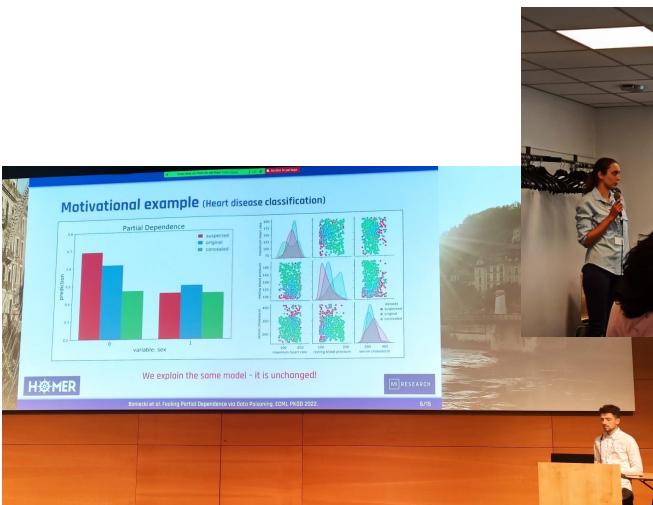


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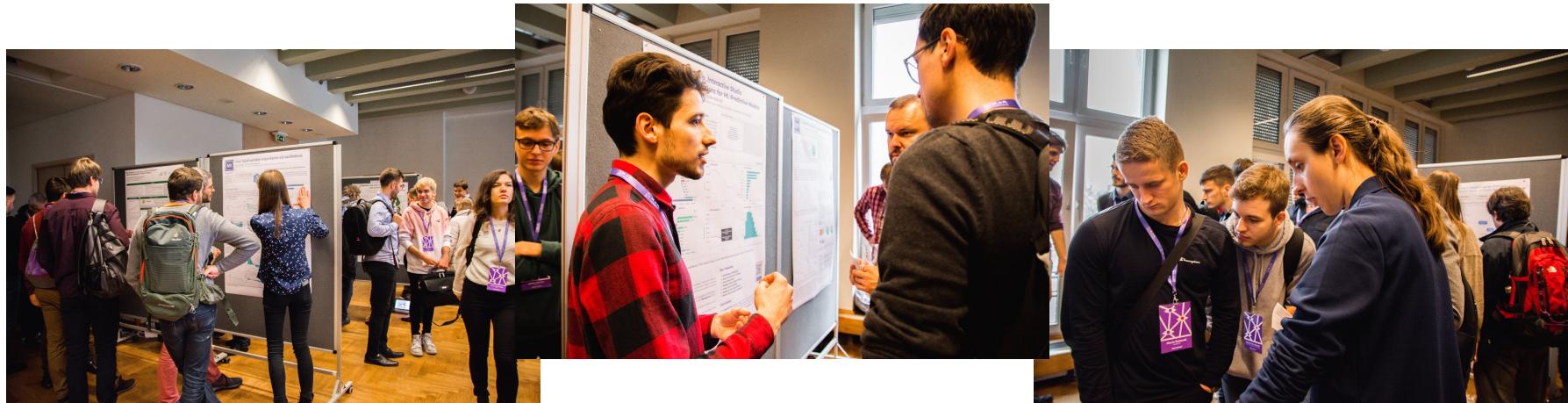


Kasia Woźnica



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Kasia Woźnica



BSc & MSc thesis

BSc



- *Adversarial attacks on Explainable AI methods*, Hubert B. & Wojciech K. (PB)
- *Narzędzie do analizy podobieństwa rozkładów metryk jakości algorytmów uczenia maszynowego w zadanej przestrzeni hiperparametrów*, Mateusz G. (KW)
- *Automation of deployment of interpretable machine learning models to cloud solutions*, Adam R. (PB)
- Szymon M. ()

MSc

- *From manipulating to evaluating explanations of machine learning models*, Hubert B. (PB)
- *Conversational explanations of Machine Learning models using chatbots*, Michał K. (PB)

Hubert Baniecki



BSc & MSc thesis

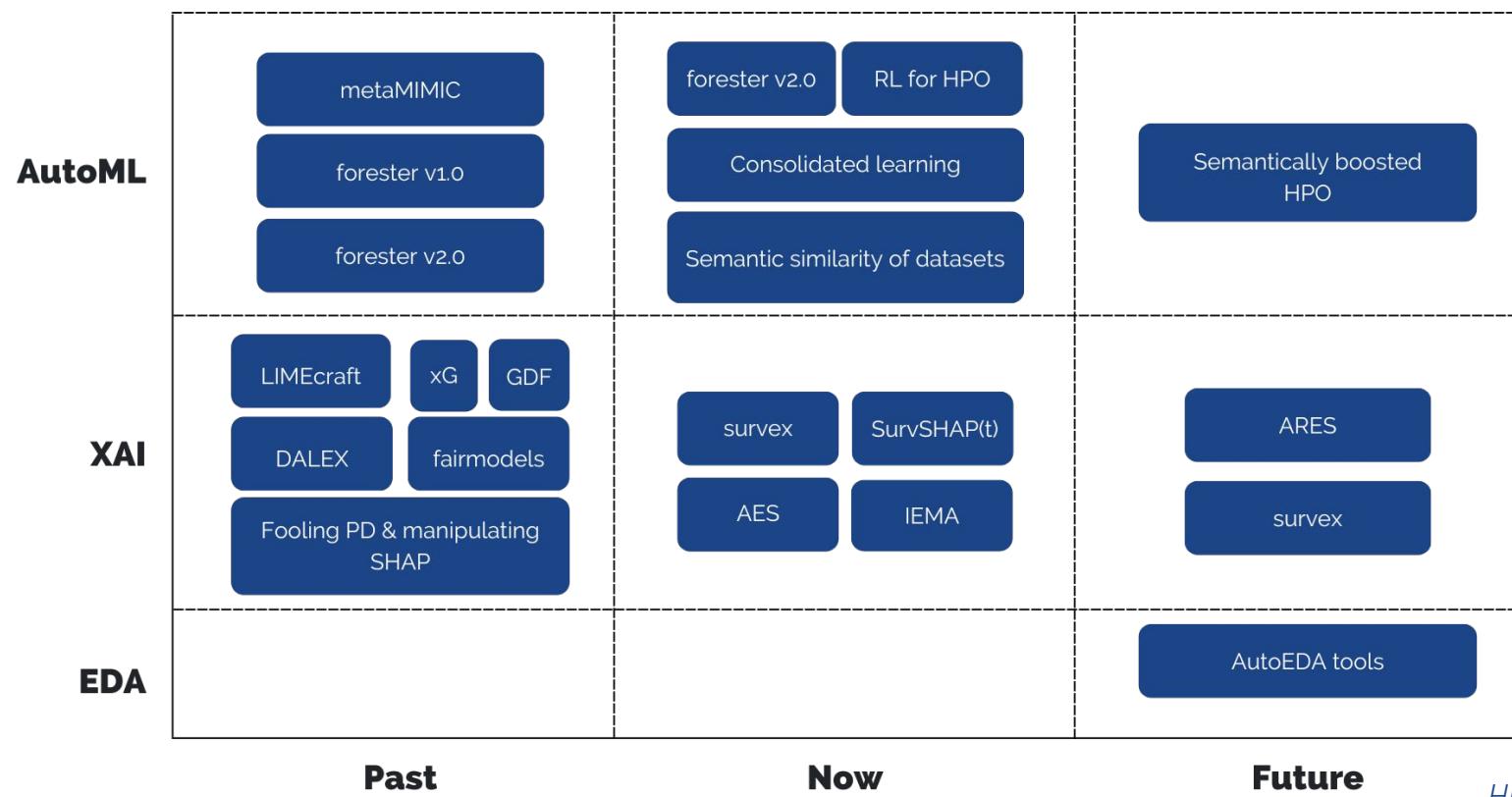
BSc



- *forester: an R package for automated building of tree-based machine learning models*, Ada G. & Hubert R. & Patryk S. (AK)
- *Methods for extraction of interactions from predictive models*, Paweł F. & Mateusz K. & Artur Ż. (PB)
- *Automated explanation selection for convolutional neural networks*, Agata K. & Mateusz S. & Paweł W. (HB)
- *Impact of data balancing on model behaviour with Explainable Artificial Intelligence tools in imbalanced classification problems*, Adrian S. (MC)

Hubert Baniecki





Hubert Baniecki

Solutions



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Solutions

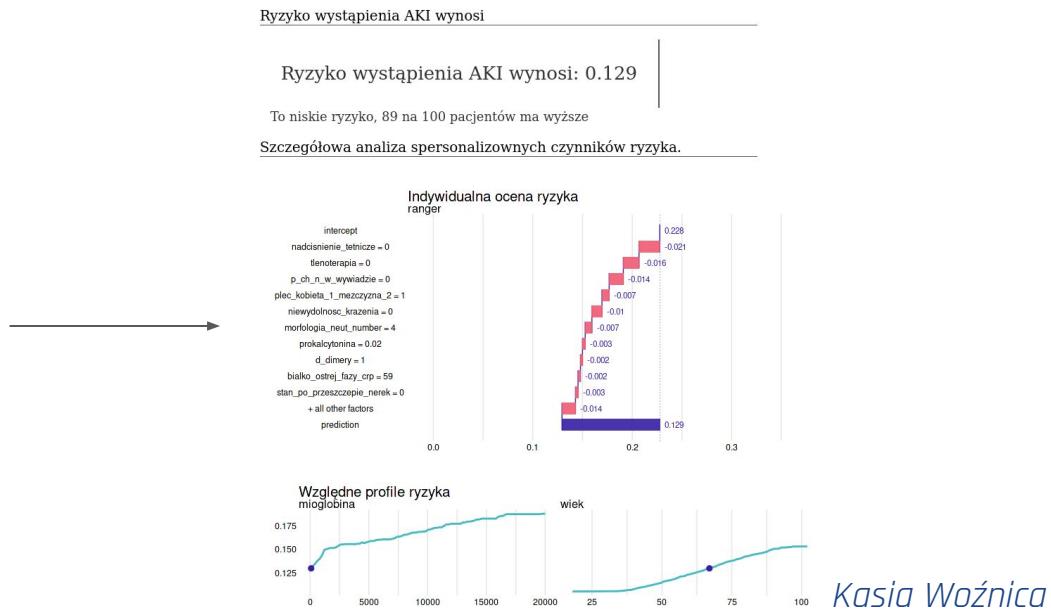




UJ nephrology team

- participating in **research project** about predicting AKI (inter-university cooperation)
- **statistical/ML consultancy**

Hack4med





Uveal melanoma research team

- participating in **research project** about uveal melanoma (international and inter-university cooperation)
 - statistical/ML **consultancy**
 - statistical/ML **leadership**

- 2 **published** articles
- 1 article & 2 conference abstracts **in review**
- 2 ongoing subprojects (connected to **survex** package)

Mateusz Krzyziński





Education



Research



Solutions

HOMER



Questions?

