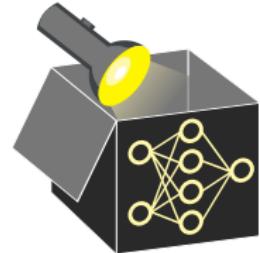
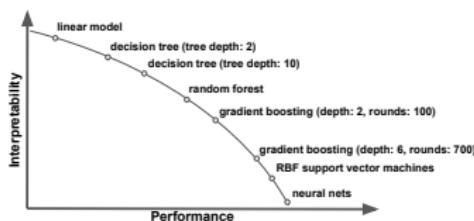


Interpretable Machine Learning



Intro to IML

Introduction, Motivation, and History

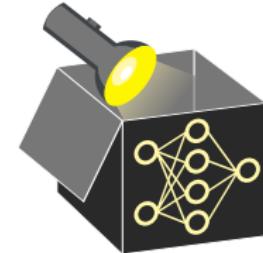
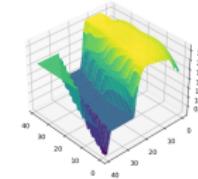
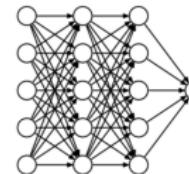


Learning goals

- Why interpretability?
- Developments until now?
- Use cases for interpretability

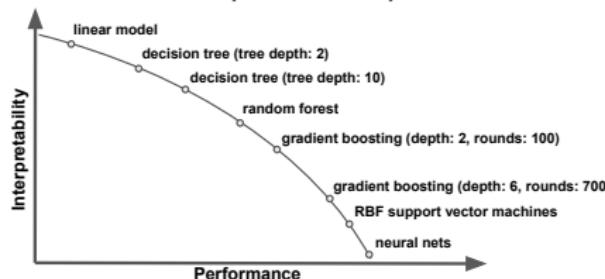
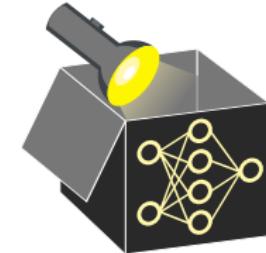
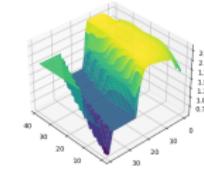
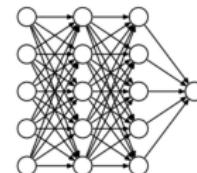
WHY INTERPRETABILITY?

- ML: huge potential to aid decision-making process due to its predictive performance
- ML models are black boxes, e.g., XGBoost, RBF SVM or DNNs
 - ~~ too complex to be understood by humans
- Some applications are "learn to understand"



WHY INTERPRETABILITY?

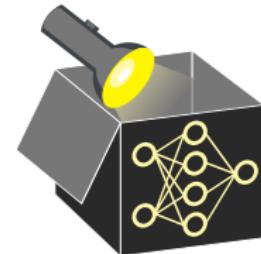
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- ML models are black boxes, e.g., XGBoost, RBF SVM or DNNs
 - ~~ too complex to be understood by humans
- Some applications are "learn to understand"
- When deploying ML models, lack of explanations
 - ① hurts trust
 - ② creates barriers
 - ~~ Many disciplines with required trust rely on traditional models, e.g., linear models, with less predictive performance



INTERPRETABILITY IN HIGH-STAKES DECISIONS

Examples of critical areas where decisions based on ML models can affect human life

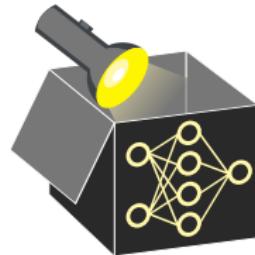
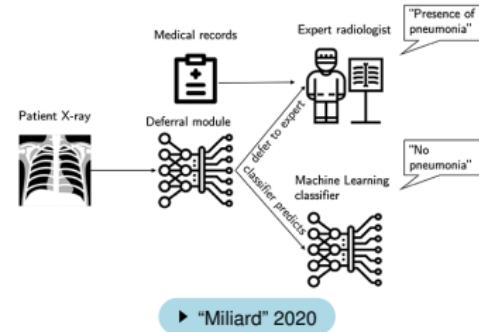
- Credit scoring and insurance applications ▶ "Society of Actuaries" 2021
 - Reasons for not granting a loan
 - Fraud detection in insurance claims



INTERPRETABILITY IN HIGH-STAKES DECISIONS

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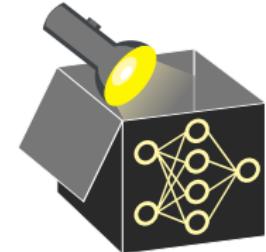
- Credit scoring and insurance applications ▶ "Society of Actuaries" 2021
 - Reasons for not granting a loan
 - Fraud detection in insurance claims
- Medical applications
 - Identification of diseases
 - Recommendations of treatments
- ...



NEED FOR INTERPRETABILITY

Need for interpretability becoming increasingly important from a legal perspective

- General Data Protection Regulation (GDPR) requires for some applications that models have to be explainable ▶ "Goodman and Flaxman" 2017
~~ *EU Regulations on Algorithmic Decision-Making and a "Right to Explanation"*
- *Ethics guidelines for trustworthy AI* ▶ "European Commission" 2019



BRIEF HISTORY OF INTERPRETABILITY

- 18th and 19th century:
Lin. regression models (Gauss, Legendre, Quetelet)
- 1940s:
Emergence of sensitivity analysis (SA)
- Middle of 20th century:
Rule-based ML, incl. decision rules and trees
- 2001:
Built-in feature imp. measure of random forests
- >2010:
Explainable AI (XAI) for deep learning
- >2015:
IML as an independent field of research



► "Carl Friedrich Gauss" 1828

► "Wikipedia" 1777

