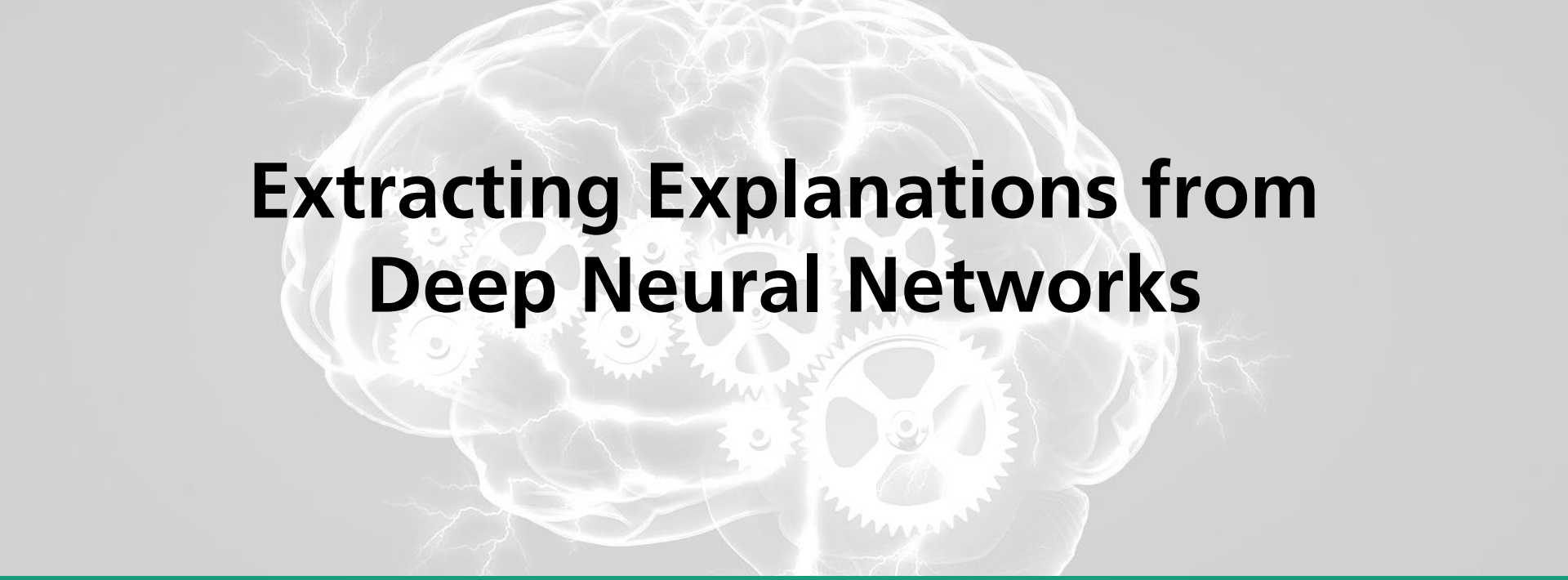

Extracting Explanations from Deep Neural Networks

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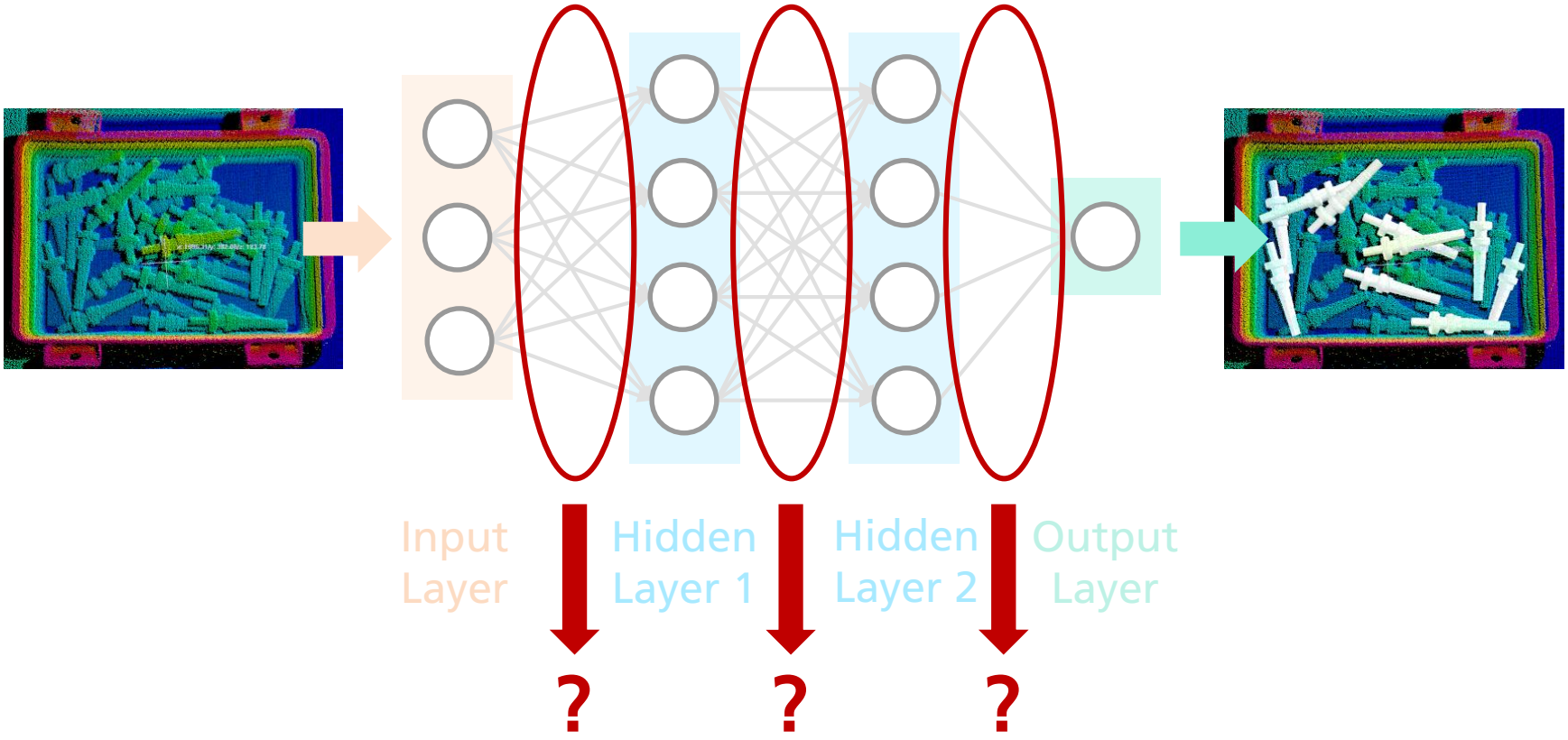
Problem



(Deep) Neural Networks are a **black box**.

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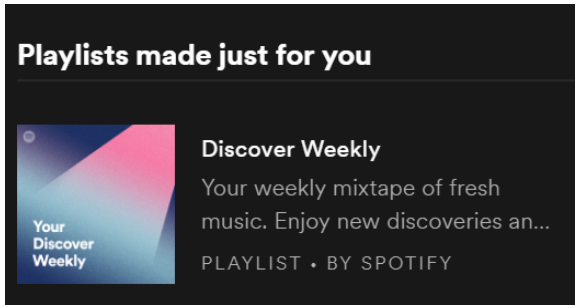
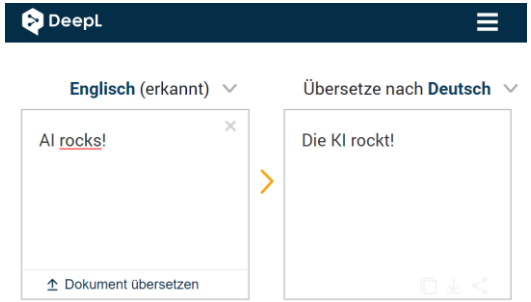
Need for Explanability?

Non-critical applications



Music recommendation



Machine translation

Critical domains

Discrimination/Bias

Law

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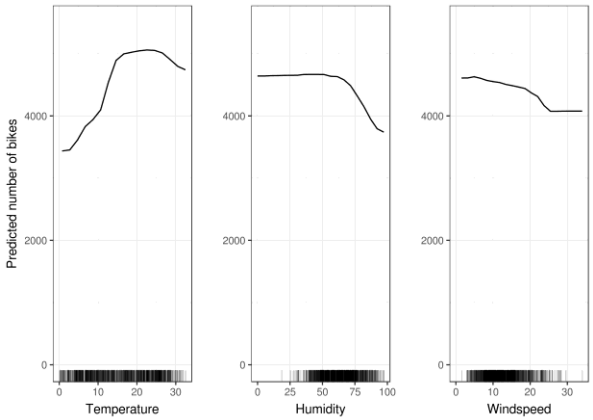
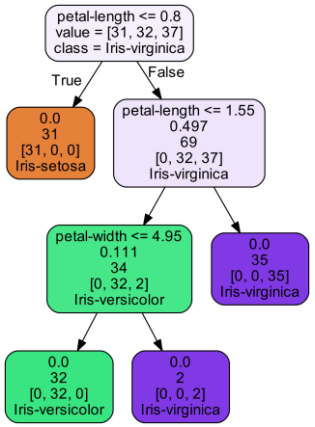
Representation Formats

Heatmap (Layer-wise relevance propagation)



Partial-Dependence Plots



Decision Tree

IF temperature > 15 °C **AND** humidity < 60% **THEN** play tennis

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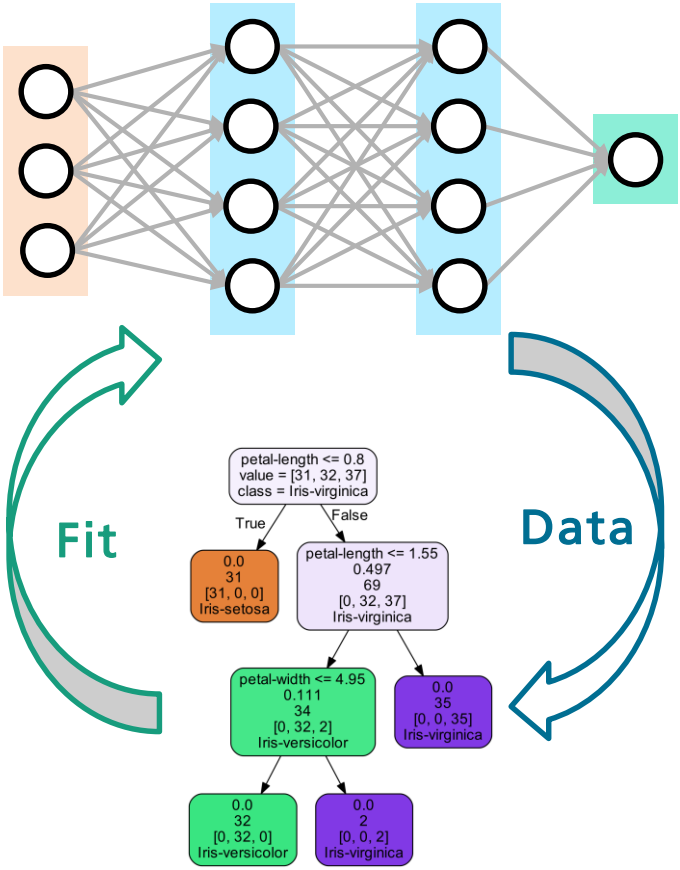
Objectives

- Representation format: **decision trees (rules)**
- Tree extraction from **deep** Neural Networks
- **Global** explainability
- **Classification** tasks



Naïve:

1. Considered trained neural network as ground truth
2. Fit decision tree to trained network
   - → Tree has limited representational power
   - → Low fidelity (fit to network)
   - → Low accuracy (fit to data)

Key Idea

- Regularization of network training in such a way that tree fitting is improved

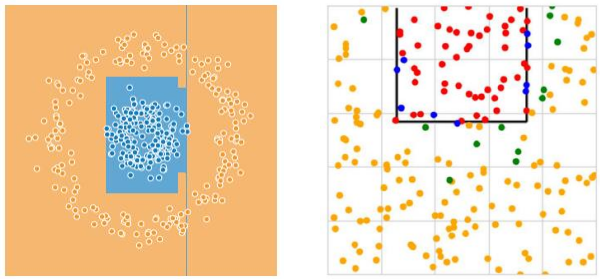
$$\underset{W}{\operatorname{argmin}} \sum_{i=1}^{n} E\left(y_i, f\left(X_i, W\right)\right) + \boldsymbol{\lambda \Omega(W)}$$

Classification loss

Regularization

→ Easy-to-match decision boundaries for decision trees

→ Simple representation with broad feature coverage



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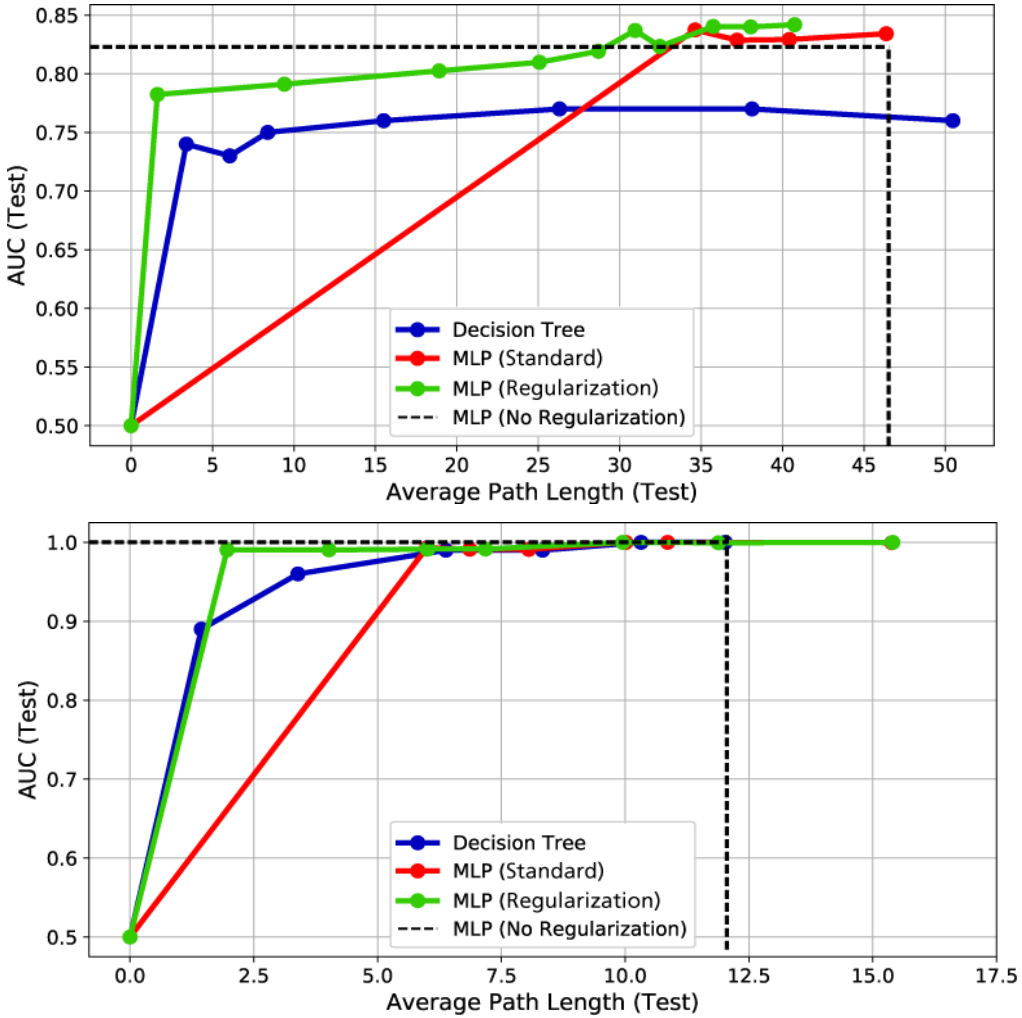
Results: Benchmark Datasets



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Thank You!

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