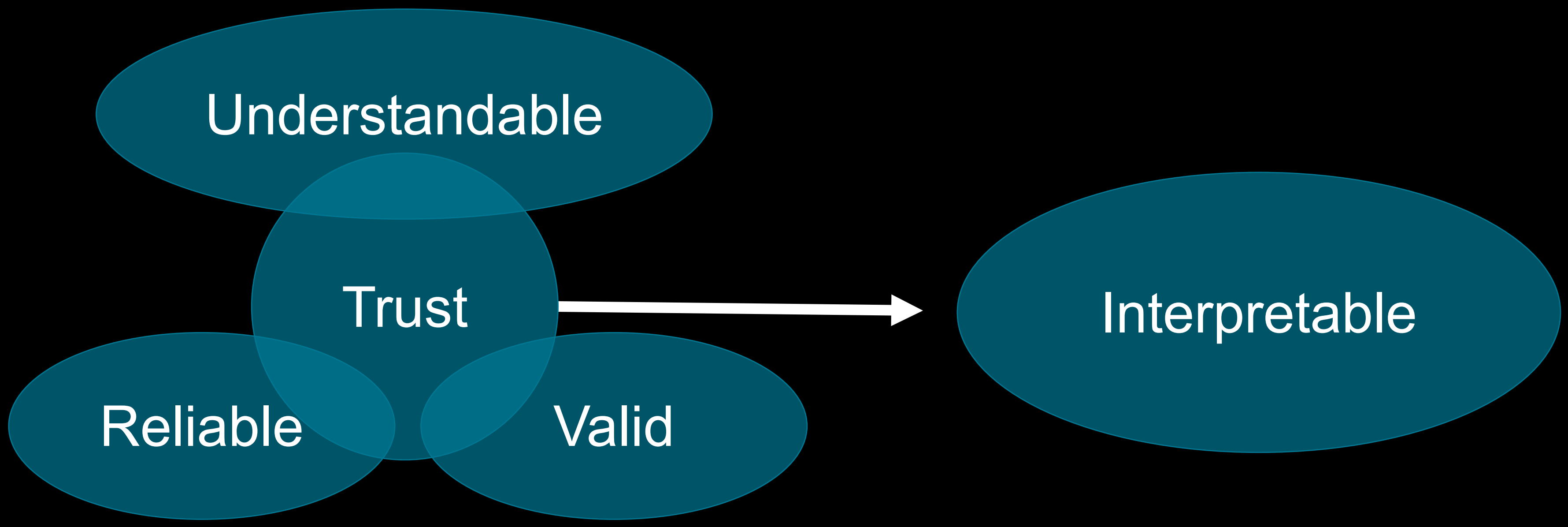
Workshop: Machine Learning Processing for Wearable Data in Healthcare

Classification and Regression Cases in Rehabilitation Event Detection

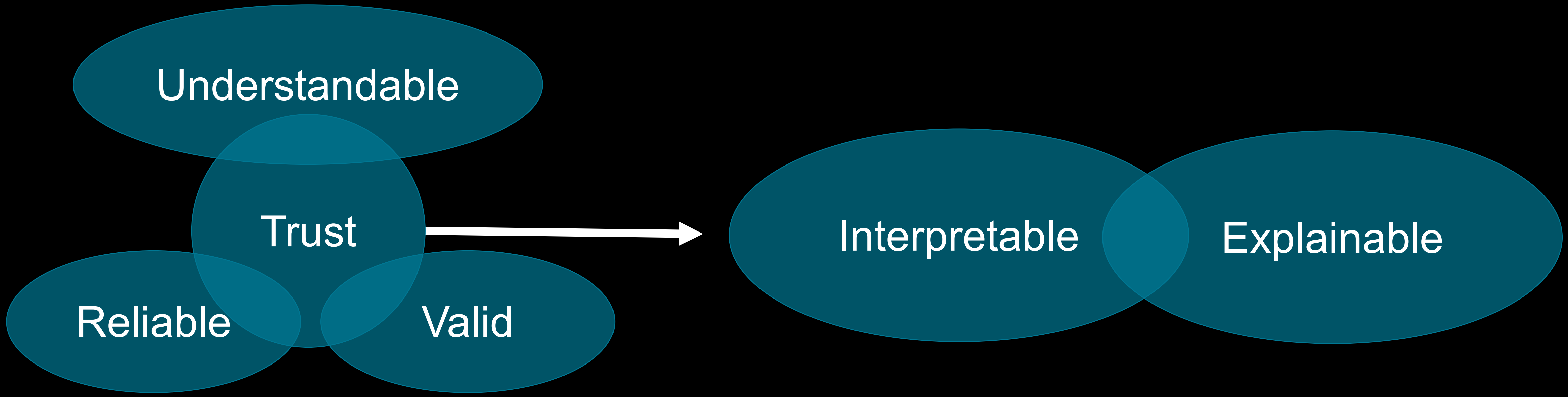
Dr Diego Paez
Mehdi Ejtehadi, Yanke Li, Bertram Fuchs



Functions

Structure

AI in Healthcare



Functions

Structure

Data

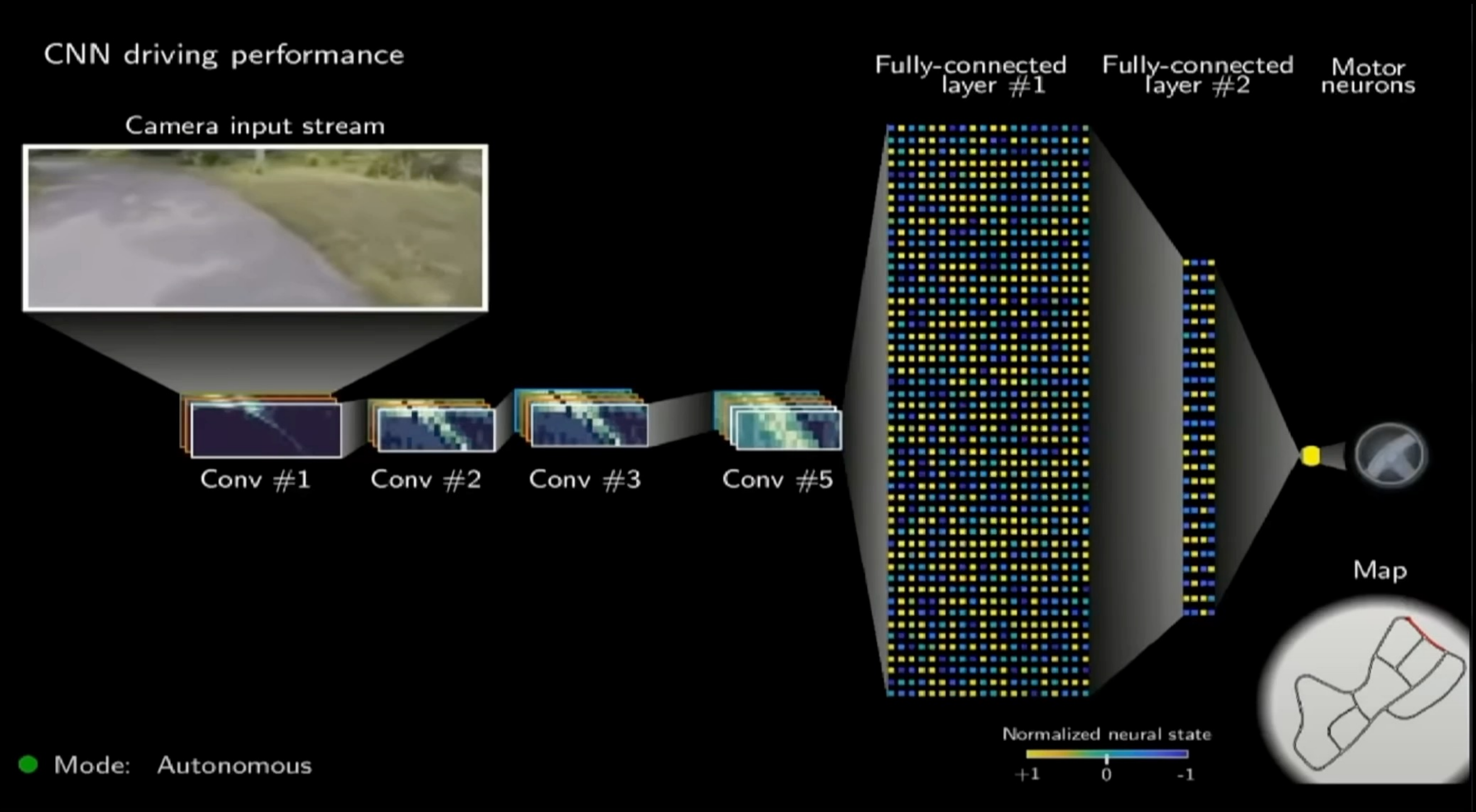
Features

Models

AI in Healthcare

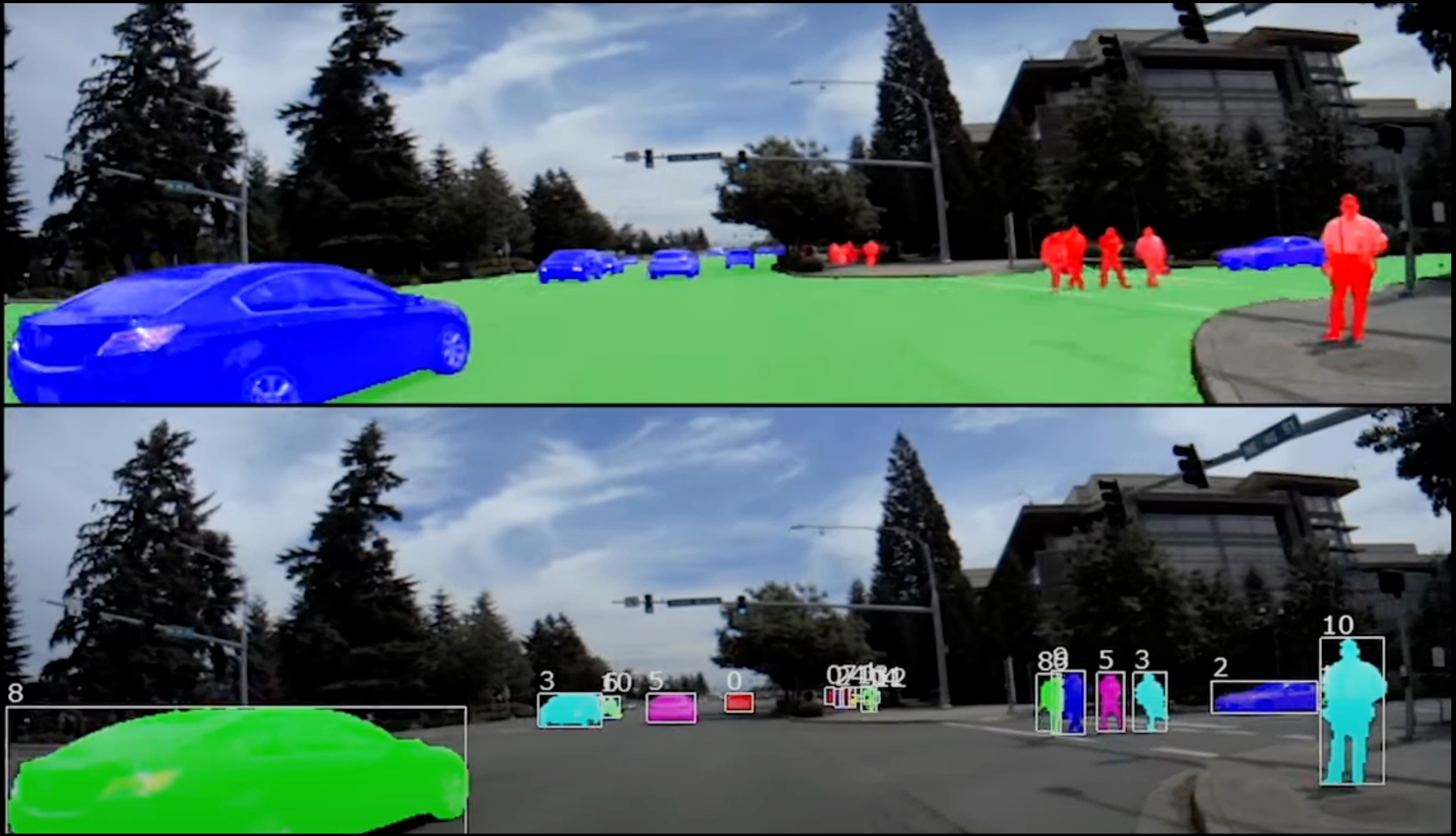
D.W. Joyce et al. Explainable artificial intelligence for mental health through transparency and interpretability for understandability. Npj Digital Medicine 2023.

Explainability in Neural Networks: Attribution Methods



Hasani, R., Lechner, M., Amini, A. *et al.* Closed-form continuous-time neural networks. *Nat Mach Intell* **4**, 992–1003 (2022). https://doi.org/10.1038/s42256-022-00556-7

Explainability



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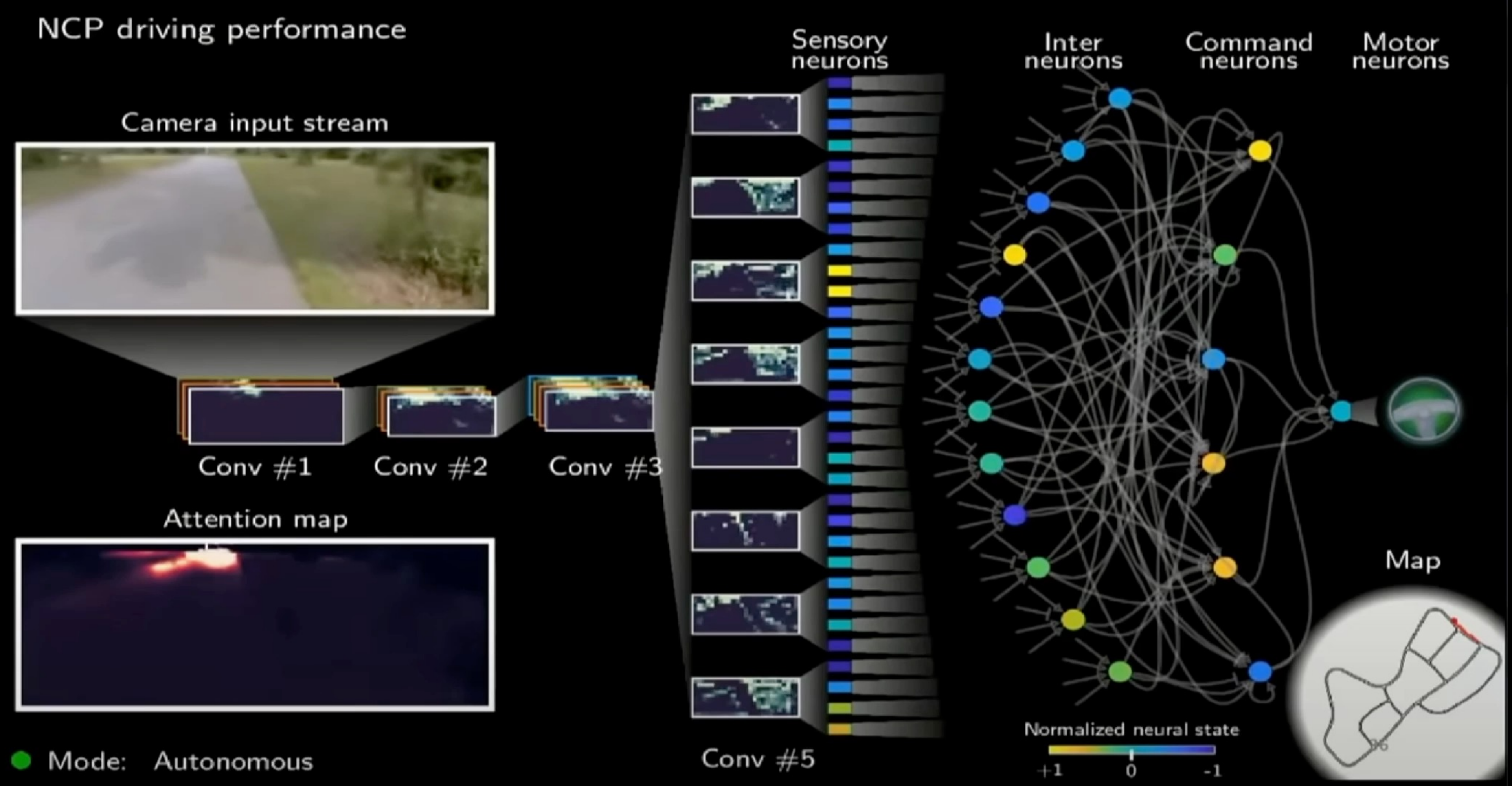
Explainability → Insufficient for OOD

Self-Driving Vehicle Accident 2021

Interpretability in Neural Networks: Addressed in Training



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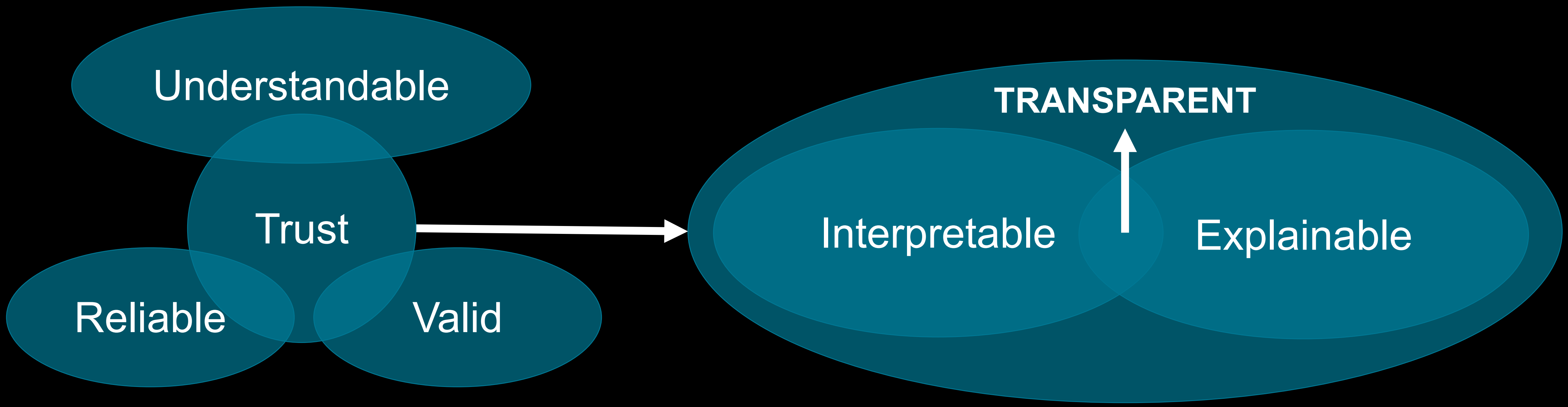

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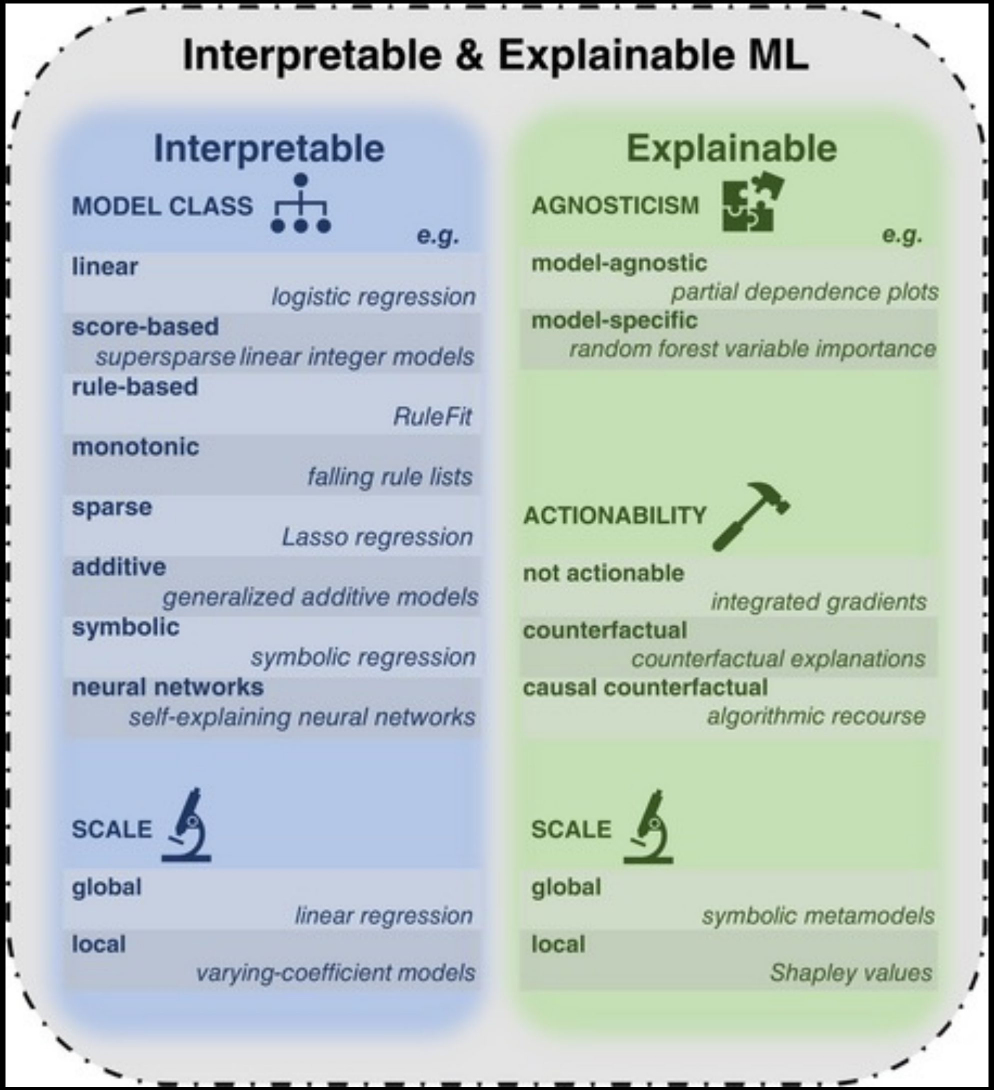
TRUST IN MACHINE LEARNING

"Explainability," giving rise to the direction of explainable artificial intelligence (XAI) (Gunning & Aha, 2019).

Doshi-Velez and Kim (2017) provide a definition of explanation that originates from psychology: "explanations are … the currency in which we exchange beliefs."

Interpretable ML focuses on designing models that are inherently interpretable.

Explainable ML tries to provide post hoc explanations for existing black-box models.

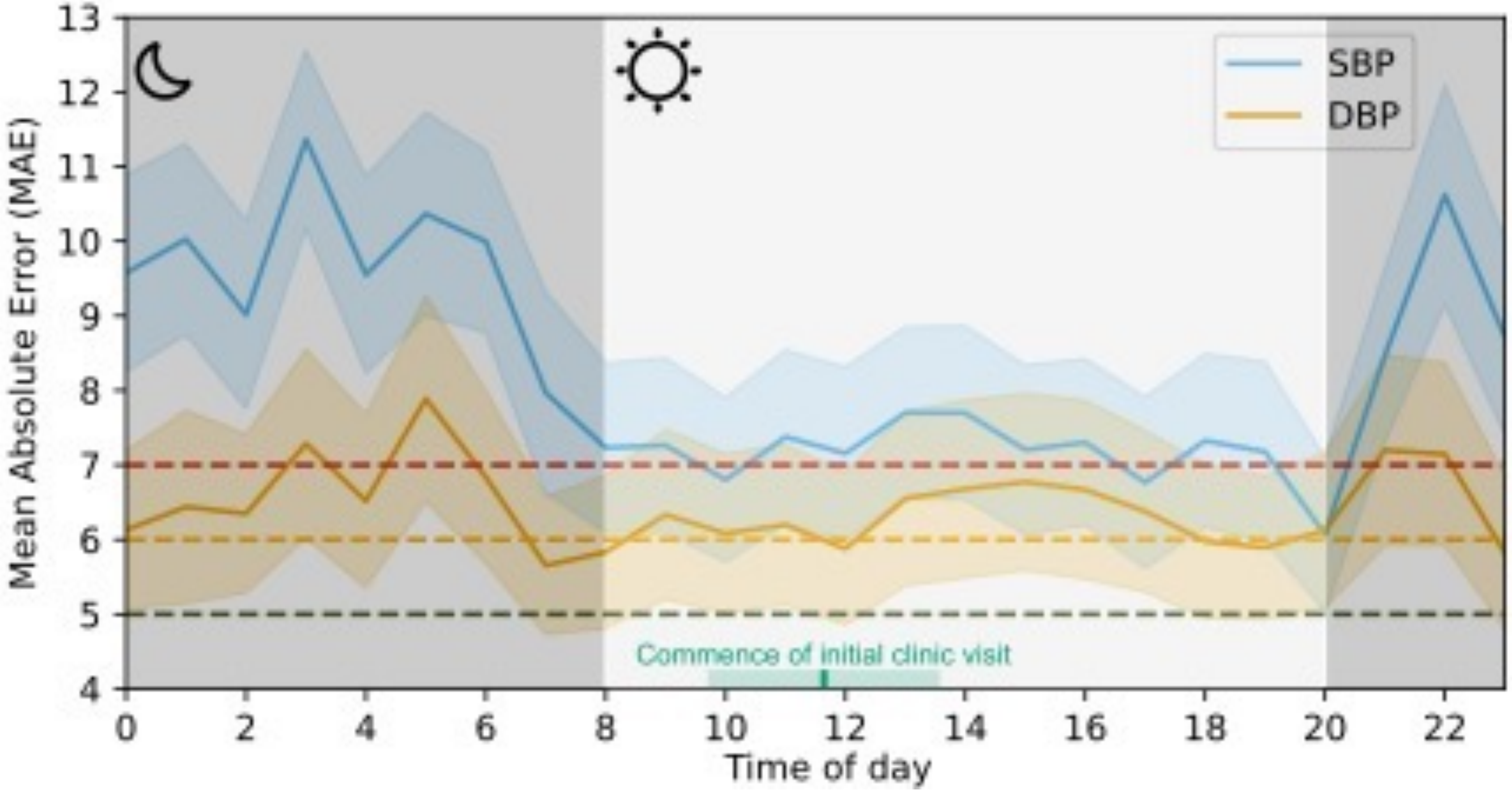


Marcinkevičs, R., & Vogt, J. E. (2023). Interpretable and explainable machine learning: A methods-centric overview with concrete examples. WIREs Data Mining and Knowledge Discovery, 13(3), e1493. https://doi.org/10.1002/widm.1493

Solutions for Transparent ML

BP Estimation using ML Regression Models

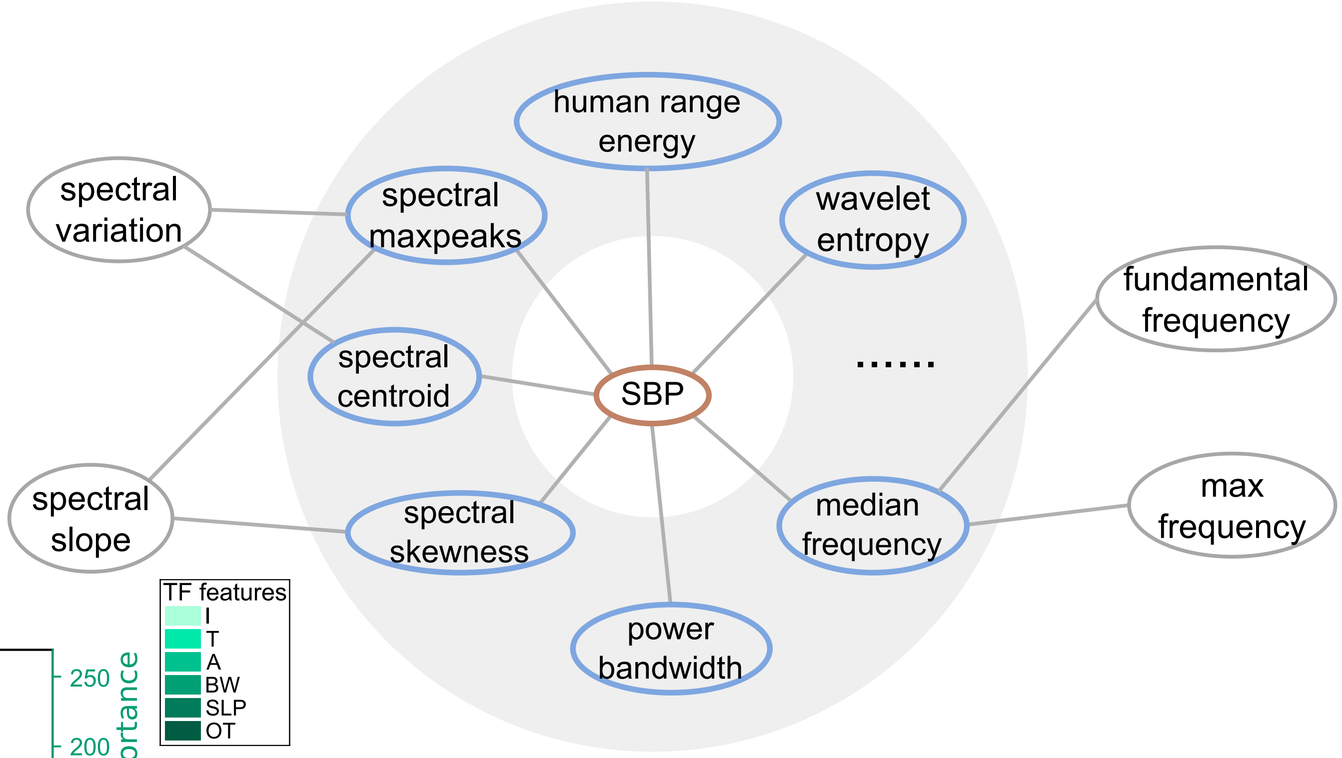
Model Performance in 24 hours recordings: BP regression

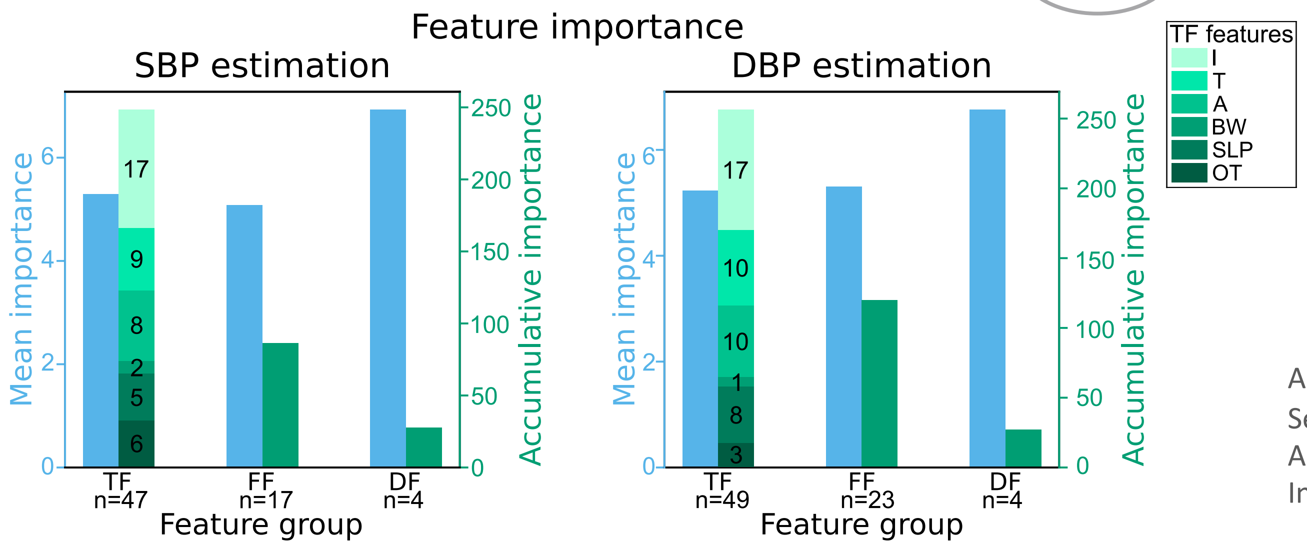


A. Cisnal, Y. Li, B. Fuchs, M. Ejtehadi, R. Riener, and D. Paez-Granados. “Robust Feature Selection for Continuous BP Estimation in Multiple Populations: Towards Cuffless Ambulatory BP Monitoring”. In: Under Review - IEEE Journal of Biomedical and Health Informatics (2023). DOi: 10.36227/techrxiv. 24112650

Blood Pressure Monitoring

Learning across multiple populations through a Markov Blanket feature selection process





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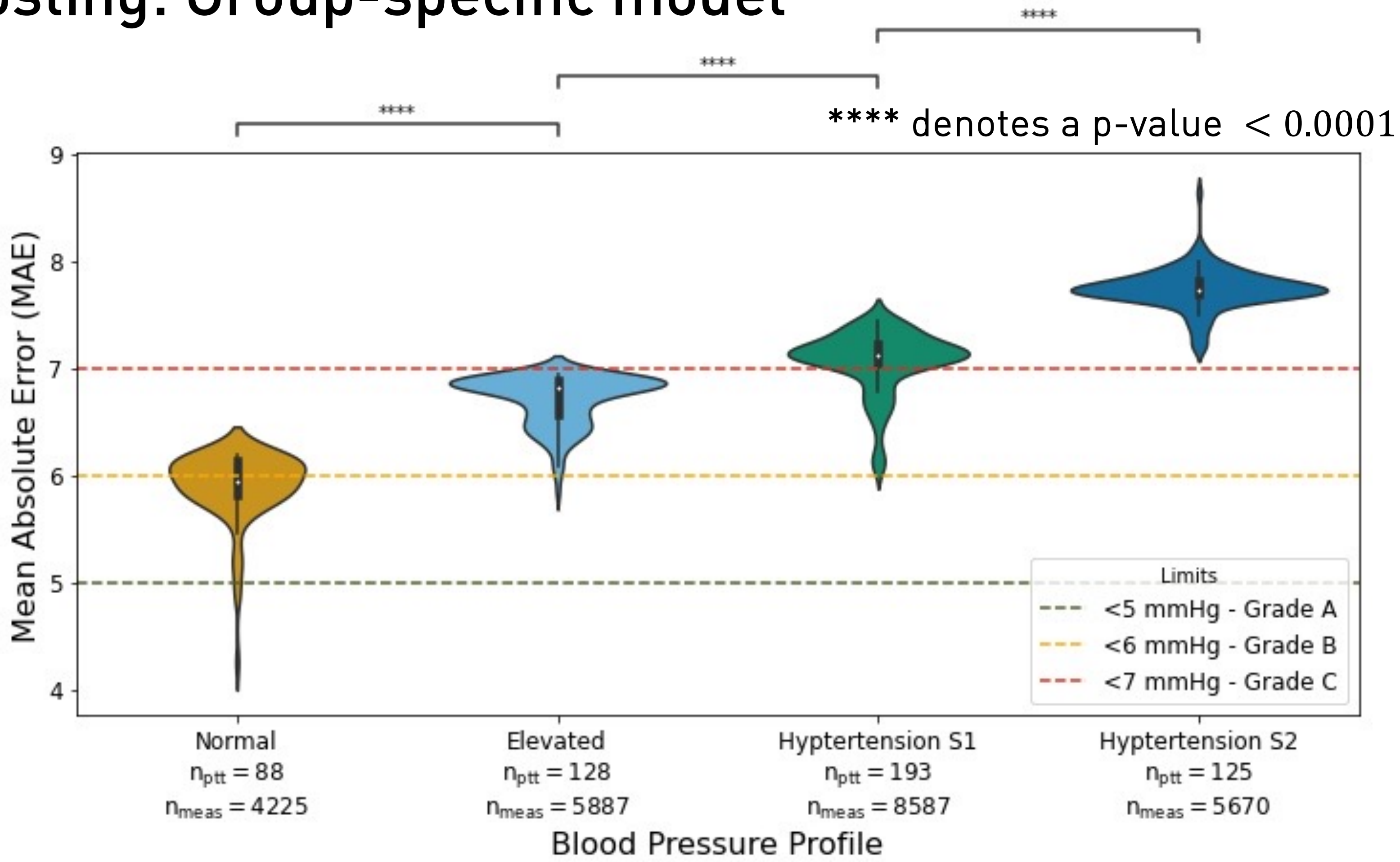
BP Estimation using ML Models

Gradient Boosting: Group-specific model



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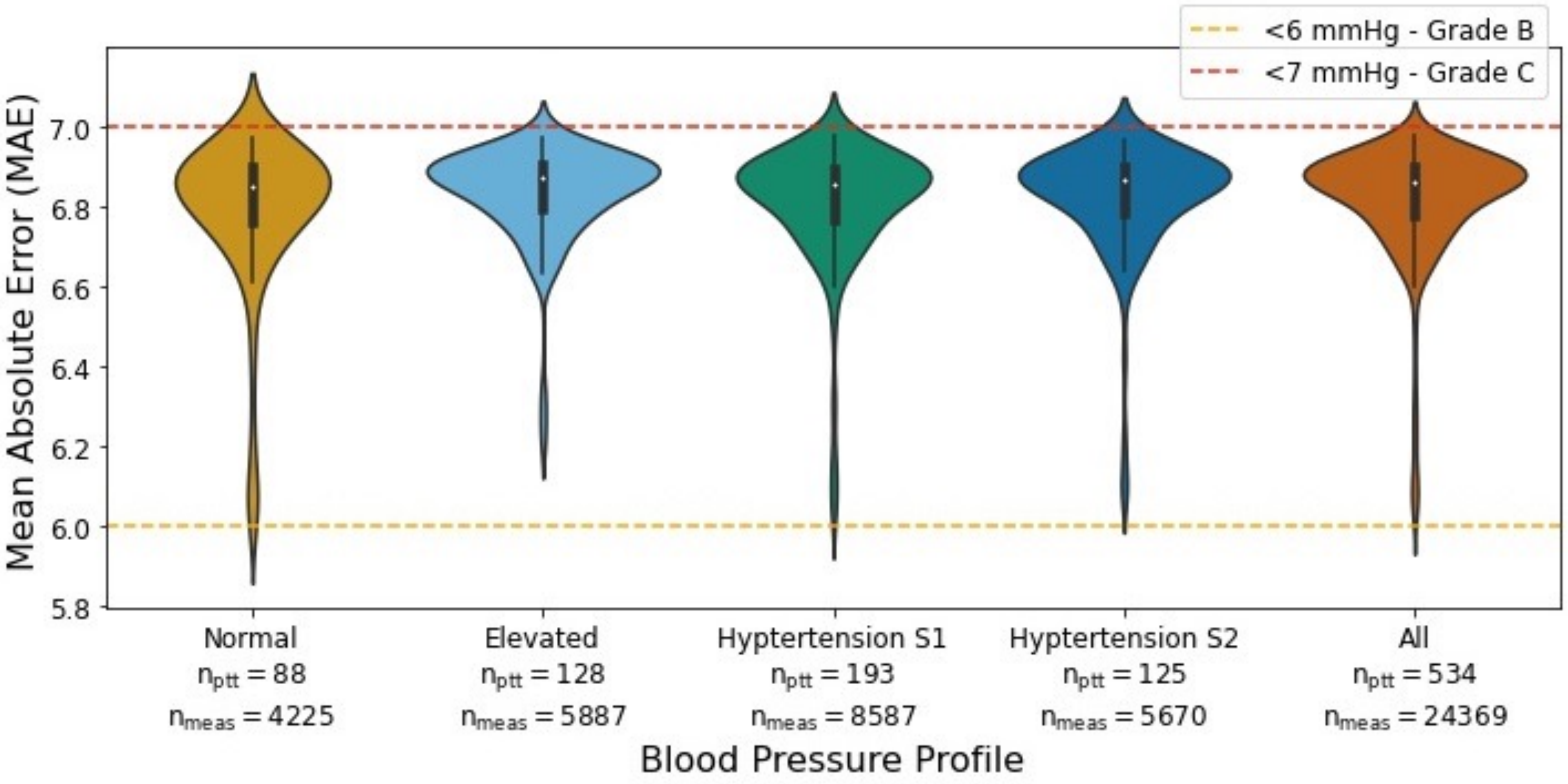
BP Estimation using ML Models

Gradient Boosting: Markov Blanket Model



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ETH zürich

Schweizer Paraplegiker Zentrum

Schweizer Paraplegiker Forschung

CAI LAB

Tutorial: Wearable Data in ADL Classification

ETH Zürich, Switzerland | 17 June 2024