UNIVERSITÄT BIELEFELD

Project Proposal

Explainable Methods for Heart rate Estimation

Background:

Remote photoplethysmography (rPPG) is a non-invasive technique used to estimate heart rate by analyzing subtle color changes in facial skin captured on video, making it valuable for healthcare applications. However, the use of deep learning models for rPPG presents challenges due to their black-box nature, which limits insight into their decision-making processes and raises concerns about trust and transparency in critical applications. Explainable Artificial Intelligence (XAI) techniques, such as DeepLIFT [1] and Grad-CAM [2], have been developed to provide visual explanations for general deep learning tasks, helping to identify which input features most influence model predictions. In this project, the primary aim is to adapt and apply these XAI methods to the specific task of rPPG estimation.

Tasks:

- Extend XAI methods (e.g., DeepLIFT [1], Grad-CAM [2]) for deep learning-based rPPG methods.
- Develop a framework to analyze and quantify the explanations provided by XAI methods on trained deep learning architectures.
- Apply the framework to evaluate the effectiveness of rPPG methods on various datasets using the explanations provided by the XAI methods.

Required skills:

- Basic understanding of neural networks and machine learning concepts.
- Proficiency in Python and familiarity with deep learning frameworks like PyTorch or TensorFlow.
- Experience with XAI tools and techniques is a plus.

Incentives:

- Hands-on experience with state-of-the-art rPPG estimation methods and XAI techniques.
- Gain expertise in handling video datasets
- Receive weekly supervision.

Supervisor(s):

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- Prof. Dr. Hanna Drimalla, drimalla@techfak.uni-bielefeld.de

References:

[1] Shrikumar, A., Greenside, P., Shcherbina, A., & Kundaje, A. (2016). Not just a black box: Learning important features through propagating activation differences. arXiv preprint arXiv:1605.01713.

[2] Selvaraju, R. R., Cogswell, M., Das, A., Vedantam, R., Parikh, D., & Batra, D. (2017). Grad-cam: Visual explanations from deep networks via gradient-based localization. In *Proceedings of the IEEE international conference on computer vision* (pp. 618-626).