Human Behaviour Understanding using advanced visual information processing

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Description: Human behaviour understanding (HBU) and recognition has gained an increased attention in recent years, being supported by the exciting advancements in Artificial Intelligence. Its scope consists of automatic monitoring and interpretation of behavioural patterns, including cues related to performed activities, followed paths or displayed affective states. Its main application resides in building adaptive and personalized systems able to respond to human actions, being applied in healthcare, consumer products, robotics, social engineering or ambient assisted living.
Objective: The overall aim of this PhD project consists in researching and developing an innovative human behaviour understanding framework, supporting the efficient and reliable processing of massive amounts of data, while producing informative summaries, enabling adaptive and enhanced user interactions. Furthermore, the framework will provide automatic selection of salient video segments, activity recognition, and identification of relationships among the main users, enabling the semantic video interpretation.
Methods: An HBU system will be developed based on the latest advancements in computer vision and machine learning, including optimized deep learning models for activity recognition, temporal localization and fusion of various relevant cues (e.g. trajectories, activities, context information). Moreover, various fusion techniques and additional modalities (e.g. audio, text) will be investigating, for coping with challenging situations, such as occlusions, noisy and low quality data, or even ethical or privacy related issues. In that regard, SOTA and novel techniques will be explored in order to find the best configurations for each task (e.g. CNNs, transformers) enabling optimized higher-level reasoning about behavioural patterns. Finding an efficient feature representation will be achieved using joint learning of a set of embeddings on various granularity levels, capturing existing dependencies between different entities. Additionally, self-supervised techniques will be investigated and deployed for reducing the cost of manual annotations. The developed framework will be validated and further optimized on publicly available or collected datasets in the human behaviour recognition domain, while its application will be in surveillance and/or assistive technology related use-cases.

Requirements: Students should be highly motivated, with good English communication skills and should have followed a MSc study with a focus in any of the following fields: Artificial Intelligence/Pattern Recognition/Machine Learning/Computer Vision.

Publications:

- D. Dotti, **M. Popa**, S. Asteriadis, "*Being the center of attention: A Person-Context CNN framework for Personality Recognition*", Transactions on Interactive Intelligent Systems (TiiS), ACM, 10 (3), 2020. Journal h-Index: 25.
- E. Ghaleb, **M. Popa**, S. Asteriadis, "Metric Learning Based Multimodal Audio-visual Emotion Recognition", IEEE Multimedia Magazine, 2020, 27(1), pp. 37-48. Journal h-index: 62.
- D. Dotti, **M. Popa**, S. Asteriadis, "A Hierarchical Autoencoder Model for Path prediction and Abnormality Detection", Pattern Recognition Letters, Elsevier, 2020, 130, pp. 216-224. DOI: https://doi.org/10.1016/j.patrec.2019.06.030. Journal h-index: 139.
- E. Ghaleb, **M. Popa**, S. Asteriadis, "Multimodal and Temporal Perception of Audio-visual Cues for Emotion Recognition", 8th International Conference on Affective Computing & Intelligent Interaction (ACII 2019), Cambridge, UK, 3-6 September 2019.
- W. Lopez Jaramillo, **E. Smirnov**, "Shapley-value based inductive conformal prediction", Proc. of the Tenth Symposium on Conformal and Probabilistic Prediction and Applications, PMLR 152:52-71, 2021.