Visualizing Interactions in Physical Spaces

Project Management and Software Development
for Medical Applications

General Info

Project Title:

Visualizing Interactions with Sensors

Contact Person: Mahdi Saleh

Contact Email: m.saleh@3dwe.ai

Project Abstract

The project introduces an innovative solution for analysing and visualizing interactions and behaviours in physical spaces such as lecture rooms or clinical environments like surgery rooms. Leveraging cutting-edge computer vision and AI algorithms, this project aims to transform raw video data into valuable insights that are presented to a human operator with heat maps. By detecting, tracking, and interpreting customer interactions, a likelihood map is generated to pinpoint areas and times of intense activity. Quantifiable metrics derived from the heat map provide objective measures to describe customer behaviour. Crucially, the entire process adheres to strict GDPR compliance, ensuring the privacy and rights of customers. The project's outcomes empower stakeholders to optimize experience and gain a competitive edge through data-driven decisions. This endeavour not only bridges the gap between online and offline analytics but also upholds ethical data usage, thereby shaping a new standard for respectful and insightful user analysis.

Collaboration partners: XPAI, 3Dwe

Student's Tasks Description

The focus is on analysing human behaviours in physical spaces with sensors through AI and computer vision. The plan encompasses data collection, preprocessing, algorithm development, and GDPR-compliant analysis. Key steps curating a dataset, implementing CV and AI algorithms, generating a heat map, extracting quantifiable metrics, ensuring GDPR compliance, and developing intuitive visualizations. Existing resources like labelled data, AI libraries, and privacy frameworks will be leveraged. The project aims to provide actionable insights to enhance experience while respecting privacy regulations, ultimately benefiting all stakeholders.

An active interaction with XPAI and 3Dwe provides insight into offline marketing and experience quantification using modern vision algorithms.

Project Plan:

1. Project Initiation and Data Collection:

- Gather requirements and finalize project scope with stakeholders.
- Curate a dataset of interactions in physical spaces such as a lecture room with existing hardware. Discuss and add different customer interactions (e.g., browsing, consulting people, getting sidetracked, …).

2. CV and AI Algorithm Development:

- Implement computer vision algorithms for customer detection, GDPR-compliant tracking, and behaviour recognition.
- Develop AI models to interpret customer behaviours based on the video data.

3. Visualization / Evaluation:

- Generate a heat map that highlights areas and times of intense customer interaction.
- Extract quantifiable measures from the heat map data, such as peak interaction periods, popular areas, and customer preferences.
- Conduct an A/B testing setup to validate the accuracy and reliability of the system and compare setup variations.

4. Documentation and Presentation:

- Create comprehensive documentation detailing the project's ideas.
- Present the outcomes and benefits of the project to all stakeholders.

Please send the completed proposal to tianyu.song@tum.de, shervin.dehghani@tum.de and felix.tristram@tum.de. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.

Technical Prerequisites

- Python and OpenCV
- PyTorch

References

Ramana Sundararaman, Cedric De Almeida Braga, Eric Marchand, Julien Pettre. Tracking Pedestrian Heads in Dense Crowd. CVPR 2021, pp. 3865-3875.

Please send the completed proposal to tianyu.song@tum.de, shervin.dehghani@tum.de and felix.tristram@tum.de. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.