HEAD-TO-BODY-POSE CLASSIFICATION IN NO-POSE VR TRACKING SYSTEMS

Tobias Feigl1,2, Christopher Mutschler1,2, Michael Philippsen2
1 Fraunhofer Institute for Integrated Circuits (IIS), Machine Learning and Information Fusion Group
2 Friedrich-Alexander University Erlangen-Nürnberg (FAU), Programming Systems Group
1 {tobias.feigl | christopher.mutschler}@iis.fraunhofer.de 2 {michael.philippsen}@fau.de

INTRODUCTION
Pose tracking does not yet reliably work in large-scale interactive multi-user VR. Our novel head orientation estimation combines a single inertial sensor located at the user’s head with inaccurate positional tracking. We exploit that users tend to walk in their viewing direction and classify head and body motion to estimate heading drift. This enables low-cost long-time stable head orientation.

PROBLEM DESCRIPTION
Low-cost no-pose tracking systems provide positions but only yield relative/wrong head orientation.

Wrong orientation results in a mismatch of the real (\(\vec{p}\)) and virtual world (\(\vec{\theta}\)) and lead to motion sickness:
- No drift: \(\vec{r}=\vec{\theta}\) feels natural;
- With +45° yaw drift: \(\vec{r}/\vec{\theta}\) feels unnatural.

IDEA
We exploit that humans walk in their viewing direction (\(\vec{m}=\vec{r}\)) and implement a Supervised Machine Learning pipeline:
- Extract features from sensor signals;
- Classify the relation between real movement direction (\(\vec{m}\)) and head orientation (\(\vec{\theta}\));

Due to a naive post-processing step (corrects false predictions such as impossible rotations from 45° to +45° within 5ms) we classify the absolute head-to-body orientations correctly in 95% of all cases (in 259\(\mu\)s).

CONCLUSION
We use inaccurate positions and noisy inertial sensors mounted at the head while VR users move on an arbitrary walk and unnoticeably correct the absolute head orientation.