

2D and 3D Human Pose Estimation

Level: Bachelor/Master (1-2 students possible)

Duration: 3 months

Start: By agreement

Mentor: Milos Petrovic

Institution: ETF Robotics

Overview and Technology: This project introduces **2D pose estimation** (localizing body **keypoints** in the image plane) and **3D pose estimation** (recovering **3D joint coordinates** and a consistent skeletal representation) from images or videos. Modern methods are typically based on **deep neural networks** trained on annotated datasets and can run in **real time** on a PC workstation, enabling applications in activity analysis, ergonomics, AR/VR, and human-robot interaction. Key practical challenges include occlusions, motion blur, unusual viewpoints, and depth ambiguity when using only a single RGB camera. Students will implement and evaluate an end-to-end pipeline, compare open-source models, and analyze accuracy-versus-speed trade-offs for both 2D and 3D outputs.

Platforms / hardware <ul style="list-style-type: none"> • PC Workstation • RGB+D camera 	Software & tools <ul style="list-style-type: none"> • Python (NumPy, OpenCV) • PyTorch or TensorFlow • MediaPipe / OpenPose / MeTRAbs
Project options (projects can be modified based on student interests) <ul style="list-style-type: none"> • Real-time 2D pose estimation (single- and multi-person) on RGB+D camera • Monocular 3D pose estimation with temporal smoothing and 3D visualization • Application demo: pose-based activity recognition or ergonomic scoring 	
Expected outcomes <ul style="list-style-type: none"> • Literature review • Project code and documentation/video • Final report in IEEE research paper form 	Recommended background <ul style="list-style-type: none"> • Digital image processing basics (camera geometry, filtering, keypoints) • Python programming (NumPy/OpenCV) and basic software engineering • Basics of machine learning / deep learning
Literature <ul style="list-style-type: none"> • MediaPipe Pose / Pose Landmarker documentation • OpenPose (Part Affinity Fields) paper and repository • MeTRAbs (absolute 3D human pose) paper and repository 	