



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	Software & tools
<ul style="list-style-type: none">• PC Workstation• RGB+D camera	<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	Recommended background
<ul style="list-style-type: none">• Literature review• Project code and documentation/video• Final report in IEEE research paper form	<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	