

## Pose Classification from 2D/3D Skeletons

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

**Duration:** 3 months

**Start:** By agreement

**Mentor:** Milos Petrovic

**Institution:** ETF Robotics

**Overview and Technology:** This project focuses on **pose classification** (recognizing discrete postures from human keypoints) using **2D keypoints** and **3D skeletons**. A typical pipeline estimates 2D keypoints from an RGB+D image/video (e.g., with MMPose or MediaPipe), optionally lifts them to 3D (e.g., VideoPose3D or MeTRAbs), and then performs classification with a deep model such as graph neural networks, an MLP/Transformer, or a spatio-temporal GCN. Students will implement and compare 2D-vs-3D features, study normalization/invariance (scale, translation, camera view), and deliver a small real-time demo on a PC workstation.

<p>Platforms / hardware</p> <ul style="list-style-type: none"> <li>• PC Workstation (GPU recommended)</li> <li>• RGB+D camera and/or public pose datasets</li> </ul>	<p>Software &amp; tools</p> <ul style="list-style-type: none"> <li>• Python (NumPy, OpenCV)</li> <li>• PyTorch + OpenMMLab (MMPose, MMAction2)</li> <li>• scikit-learn + visualization (Matplotlib/3D viewer)</li> </ul>
<p>Project options (projects can be modified based on student interests)</p> <ul style="list-style-type: none"> <li>• Train a pose classifier for static postures (e.g., sport, safety poses, simple gestures)</li> <li>• Compare 2D skeleton features vs lifted 3D skeleton features</li> <li>• Explore deep models for skeletons (MLP/Transformer, ST-GCN-style baselines) and optimize for real time</li> </ul>	
<p>Expected outcomes</p> <ul style="list-style-type: none"> <li>• Literature review</li> <li>• Project code and documentation/video</li> <li>• Final report in IEEE research paper form</li> </ul>	<p>Recommended background</p> <ul style="list-style-type: none"> <li>• Digital image processing basics and camera geometry</li> <li>• Python programming (NumPy/OpenCV) and basic software engineering</li> <li>• Basics of machine learning / deep learning</li> </ul>
<p>Literature</p> <ul style="list-style-type: none"> <li>• MMAction2 model zoo: <a href="https://mmaction2.readthedocs.io/en/latest/model_zoo/recognition.html">mmaction2.readthedocs.io/en/latest/model_zoo/recognition.html</a> (also <a href="https://mmaction2.readthedocs.io/en/latest/skeleton.html">skeleton.html</a>)</li> <li>• MMPose (OpenMMLab) documentation and repository</li> <li>• ST-GCN paper; PySKL toolbox for skeleton-based action/pose classification</li> <li>• Graph-based pose classification methods (GCN-based models)</li> <li>• OpenPose / MediaPipe for pose extraction</li> </ul>	