Coursework 1: Human-aware Collaborative Robots in Manufacturing Settings

7CCEMSAP Sensing & Perception

Dr Oya Celiktutan, 9th November 2025

- This project will count for **70%** of your total grade in the course.
- Remember that all work you submit should be **your own work**. The College treats plagiarism very seriously.
- You should submit your report by **9th December 2025** using the submission link on the KEATS site for 7CCEMSAP.
- If you have more general or administrative problems please use the online forum or consult during drop-in-sessions or support sessions. If an email is required, please include the course number (7CCEMSAP) in the subject line.

1 Motivation

Industry 5.0 is a transformative shift in manufacturing that places human robot collaboration at its core. This matters because today's robots still struggle to adapt to unfamiliar situations. By pairing robots with human partners, we can let robots handle repetitive, structured work while humans focus on tasks that rely on domain expertise and higher level reasoning, such as detecting failures. This division of labor reduces cost and lightens the cognitive and physical burden on human workers. To reach this future, robots need more advanced human activity recognition so they can understand and adapt to their human coworkers beyond verbal instructions. In particular, robots must be able to interpret human actions and activities directly from video. Such capability would allow collaborative robots to act more proactively, anticipate needs, and contribute more effectively toward shared goals.

2 Objective

The main objective of this project is to develop an perception algorithm to recognise human activities in manufacturing settings. The students will be provided a dataset, where they can download the training data sets (with annotations provided) to develop and evaluate their algorithm. A test set (without annotations) will be also provided to evaluate the methodology on the unseen portion of the dataset.

3 Assessment Criteria

Each project will be assessed on reproducibility (50%), originality (25%), and justification (25%).

Reproducibility (50%) refers to how easily your results can be reproduced. This includes the clarity and cleanliness of your code, the transparency of your workflow, and the completeness of your documentation. Make sure your README file is clear and detailed so that another person can run your code and obtain the same results.

Originality (25%) reflects how fresh and innovative your approach is. This can involve proposing a new idea or adapting an existing method in a meaningful way. Even an incremental contribution counts,

as long as the team demonstrates genuine effort to go beyond a basic off the shelf solution.

Justification (25%) evaluates how well your design choices are supported. This includes showing awareness of relevant literature, explaining why you selected particular methods or parameters, and demonstrating that your algorithm is informed by evidence rather than arbitrary decisions. During the oral presentation, teams should also be able to answer questions clearly and defend their approach.

Please refer to the marking rubrics for more information, which will be shared shortly.

4 Dataset

For the description of the dataset, please refer to the paper: HRI30: An Action Recognition Dataset for Industrial Human-Robot Interaction.

5 Project Description

In this project, students are expected to develop a perception algorithm that can recognise the actions performed by humans in video recordings. You may use the provided training dataset to train your model, as well as create a validation set for tuning and optimising your parameters. You're free to work with either the RGB video data or the extracted skeleton data, depending on the approach you prefer.

The goal is to design a system that can interpret human activity reliably and generalise to new, unseen video samples.

6 Deliverables

Each team must submit their code and final test set results before the deadline.

The results should be submitted to Oya at oya.celiktutan@kcl.ac.uk, following the same format as the training-set label file.

Please refer to the file `annotations/training_set_labels.csv` in the shared folder. When submitting your test results, please ensure that they follow the same format and are named `test_set_labels.csv`.

Each team may submit their results up to three times at any point before the deadline, prior to submitting their final version, to check their progress.

The submitted results will be displayed on a leaderboard. The link will be shared shortly.

After the deadline, teams will present their work during the final lab sessions on 11 and 12 December. Each team is required to prepare a poster. Click here to see a blog about how to make a scientific poster.

All team members must attend the presentation. If any member is absent, the group will receive a mark of zero.

If you have any questions, do not hesitate to reach out. Good luck! ♣