EEE4114F: Project Report Information

Jarryd Son

1 Introduction

For this project you will write up a report regarding the development and implementation of a machine learning classifier for the human activity recognition (HAR) using the MotionSense dataset [1]. The aim of the report is to provide details surrounding the context to the problem, information about the design of the solution, and a critical analysis of the reported results.

2 Format

The following specifications for the report are provided

- Latex is advised for the writing of the report, however Word documents will be accepted.
- Please format it as a single column report.
- Page limit: 15 pages including references and appendices.
- Font size: 10pt for the body of the report.
- Please use IEEE style referencing.
- Submit the report as a single PDF file. An Assignment submission will be made available on Amathuba.
- Links to a code repository are allowed, otherwise you will be allowed to submit source code as a submission.

3 Details

You will be allowed to work in pairs or individually for this report. Aim to include the following sections in your report:

- Introduction/Background to the report that provides some context to the problem.
- A short literature review that discusses some of the research in the field of human activity recognition that is relevant to the project. For example, the following papers [2, 3, 4] might assist in understanding possible pre-processing steps for these types of data. Providing a short review might clarify certain processes needed for your solution. This is not on the level of a final year thesis of course, so we are not expecting significant review, just enough to show your thoughts on what already exists.
- A design section that describes aspects such as data pre-processing, resampling methods, algorithms to be used for your solution etc. You could make use of block diagrams and flow charts to assist your descriptions.
- A results section to show how the model performed. Poor results will not necessarily result in bad marks, as long as there is reasonable analysis for the results that are obtained.
- A discussion section where you should provide your analysis of the results.

- A conclusion to finish off the report.

This is not necessarily an ML exclusive project, as you could lean more into DSP aspects and compare performance of a simple machine learning model when different pre-processing methods are applied.

You are allowed to use any algorithms as part of your solution, as long as the decisions are justified. For example, you could transform the raw IMU data using an FFT, but please mention in the report why this was done given the context of your approach.

You are allowed to use pre-trained models, but you will need to provide sufficient work that is your own e.g. if using a pre-trained model, then using models from other domains and appropriately fine-tuning on the MotionSense data is acceptable, but further work around hyperparameter tuning for example, would be better.

The marking will align with the rubric for the final year project which is provided in Appendix A and with the following distribution of marks:

- Background and literature review: 10%
- Design and theory: 20%
- Practical work: 35%
- Interpretation and analysis of results: 25%
- Presentation: 10%

Good luck!

A Marking Rubric

Missing or totally unacceptable academic level

EEE4022F/S FYP – Rubric

Criteria	0-39 %	40 to 49% Unacceptable	50% to 59% Acceptable	60% to 69% Good	70% to 74% Very Good	75% to 85% Excellent	86% to 100% Outstanding
a) Problem statement & literature review: Was the research question / engineering problem clearly formulated and achievable? Did the student understand the nature of the investigation? Is the literature covered, relevant, thorough, pertinent, of good quality and suitably extensive?		Poorly formulated research question/ engineering problem. Fragmented, incomplete and unclear research question/engineering problem. Superficial discussion and/or no academic sources.	Not completely clear; but reasonable attempt at formulating achievable question/ problem. Relevance and engagement in part but remains unfocused, unclear link to question/problem, literature missing and/or unreliable.	Good question/problem formulation but verbose and beyond scope of report. Reasonably relevant, linked to question/problem, some important literature covered.	Clear question/problem formulation but perhaps not achievable within the report scope. Relevant, linked to question/problem, majority of important literature covered. Clear and achievable question/problem concisely stated.	Mastery in question/problem formulation - strongly crafted within achievable scope of report. Strong relevance linking literature to question/problem and comprehensive coverage of the important literature.	Original, engaging, and thought provoking research question/engineering problem. Critical engagement with literature. Relevant, supports question/problem, covers all aspects, credible sources used.
b) **Design and Theory** Is there clear development of theory? Is the design well described? Is the description clear enough to allow another student to duplicate it? Does the understanding of the theory inform the design of the project.		Very little understanding, poor application of theory.	Some discussion of method and limitations. Incomplete theory development and design description.	Partial discussion of method and limitations, some theory development. Weak design description.	Satisfactory discussion of method, some limitations, and justification for using method in terms of question/problem. Solid design description	Thorough discussion of method and limitations. Good theory development and complete design description for replication.	Creative development of methodology/theory which progresses method in the field. Meticulous care in design description.
c) **Practical work, simulation and software** How much practical work has been done? How relevant was it to the topic? Were the procedures verified, either by experiments or clear reasoning?		Inadequate practical work done i.t.o. quantity and quality.	Barely adequate in terms of either quantity or quality, some useful content.	Adequate in terms of quantity and/or quality but fails to address questions/problem fully.	Suitable practical work done which addresses research questions convincingly.	Thorough practical work done which fully covers question /problem.	Exceptional rigour demonstrated in practical work.
d) **Results: Interpretation and conclusions** Are the results interpreted clearly? Are the conclusions reached clearly supported in the results and linked to the research question/engineering problem? Are suggestions made for further research?		Superficial and/or irrelevant analysis. Little or no synthesis of information, no link to research questions/problem, no suggestions for future research.	Little synthesis of information, some interpretation, but poor link to research questions.	Some interpretation which partially answers research question/engineering problem. Some weakness in summary of results and suggestions for future research.	Good attempt, but some conclusions absent or not fully supported. Adequate analysis which covers basics of research questions/engineering problem. Some suggestions for further research/work.	Accurate analysis, drawing out features of the data and speaking to research questions/engineering problem. Good suggestions for further research.	Creative analysis which draws out pertinent solutions to research questions /problem & highlights additional features. Succinct and precise conclusions. Useful and creative suggestions for future research offered.
f) **Presentation, layout, referencing** Is the report done in a professional way? Is the use of grammar acceptable? Is the material properly referenced?		Unprofessional work. Poor grammar. Refs missing, poor understanding of citation conventions.	Problems with layout, careless grammar errors. Presentation unsatisfactory. Some facts not referenced.	Layout and presentation could be improved. Referencing sometimes patchy, mistakes made with grammar.	Layout and presentation acceptable. A few minor errors in grammar and referencing.	Very few, if any, errors in citations. Care demonstrated with grammar, layout and presentation.	No errors in referencing and grammar. Presentation and layout thoughtful and professional.

References

[1] M. Malekzadeh, R. G. Clegg, A. Cavallaro, and H. Haddadi, "Mobile sensor data anonymization," in *Proceedings of the International Conference on Internet of Things Design and Implementation*, ser. IoTDI '19. New York, NY, USA: ACM, 2019, pp. 49–58. [Online]. Available: http://doi.acm.org/10.1145/3302505.3310068

[2] M. Malekzadeh, R. Clegg, A. Cavallaro, and H. Haddadi, "Dana: Dimension-adaptive neural architecture for multivariate sensor data," *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, vol. 5, no. 3, pp. 1–27, 2021.

[3] D. Altunkaya, F. Y. Okay, and S. Ozdemir, "Image transformation for iot time-series data: A review," *arXiv preprint arXiv:2311.12742*, 2023.

[4] A. Nouriani, R. McGovern, and R. Rajamani, "Activity recognition using a combination of high gain observer and deep learning computer vision algorithms," *Intelligent Systems with Applications*, vol. 18, p. 200213, 2023.