STTHK 3013 (PATTERN RECOGNITION & ANALYSIS)

A241 – Mini Project II (20 %)

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Submission date: 12th February 2025 (before 11.59 pm) via UUM Learning Portal

"Raise your words, not voice. It is rain that grows flowers, not thunder." [Rumi]

HUMAN FIGHTER PILOT PERFORMANCE ANALYTICS

Human Fighter Pilot Performance refers to a pilot's ability to effectively fly and fight in a high-performance fighter jet. It's a complex mix of physical and mental skills that need to be at their peak during missions. Fighter pilots operate under extreme conditions and are required to maintain high cognitive and physical performance levels. Their performance can be influenced by several physical, psychological, and environmental variables. Understanding these variables can help in improving training programs, mission planning, and support systems to enhance overall performance and mission success.

This mini-project continues your previous case study in the Modeling & Simulation course (SKIH 2123 – A232). For that project, you were required to build a mathematical model and execute several simulation results with verification and validation procedures. In this course, you are required to develop a working prototype that is powered by a pattern recognition algorithm (e.g. machine learning / deep learning model) – or data-driven model based on the obtained dataset: STTHK3013_pilot_performance_simulation_data.xlsx.

Later, this model will be executed using a live-feed dataset from this source file: STTHK3013_pilot_performance_livestream_data.xlsx to show the implemented results in the real-world application (as an alternative to the real-time sensor systems).

INSTRUCTIONS:

In general, based on your selection, you are required to:

- Form a group of 2-4 people (Note: You can do this alone too).
- Describe your data (attributes/features) through suitable visualisation approaches.
- Identify possible missing values (if any, you need to explain how to overcome this issue)
- You are required to analyse these datasets by using at least **THREE (3)** methods.
- Perform some experiments (through hyper-parameter settings) to obtain the best classification results (at least 80 per cent)
- Your solution should have a working prototype with adequate graphical user interfaces to execute the live stream simulated conditions.

- Evaluate your results based on appropriate methods (e.g., Confusion Matrix / RMSE /ROC-AUC)
- Conclude your findings based on your experimental results.
- Simulate your application using a live-feed dataset from the given dataset. STTHK3013_pilot_performance_livestream_data.xlsx

You are required to answer all questions and submit your solution based on:

- Report that contains the answers
- Codes
- Prototype (make sure it is executable and free from error)

IMPORTANT QUESTIONS:

These questions give you a critical checklist to ensure the correctness of your deployed solution.

Before Starting the Pattern Recognition & Analysis Project Checklist

- What question are you asking/answering, and for whom?
- What data are you using?
- What techniques are you going to try?
- How will you evaluate your methods and results?
- What do you expect the result to be?

What Techniques Are You Going to Try?

- What methods/techniques should I use?
- Why do I think these are the correct methods/techniques for this problem and data set?
- Are there similar projects/references/papers that have already done this that I can learn from before I get started?
- Are these techniques that I would want to use/do in a predictive analytic job?

How will you evaluate your methods and results?

- How will I know I did the analysis and project correctly?
- What are critical parts of the project that will tell me that I am doing things incorrectly?
- What numbers/results/insights will I sense check?

What do you expect the result to be?

- What do I expect the result to be?
- Why do I expect the result to be this?
- Does this result match the results/experiences of other people with similar methods and techniques on similar data?

REPORT:

- **Introduction**
  - Why is your task important? Why should one care? What task are you attempting to cover? How are you covering them? Is there a particular technical challenge/problem you attempted to solve?
- **Background**
  - What methods or ideas have you built on? Any background on the domain topic that one might need to know to understand the application?

- **Methods**
    - How did you do it? Which methods? Which setting / hyper-parameters? Be sure to make clear how the frameworks and concepts were used.
- **Evaluation/Results**
    - What were your results? How accurate were they? What insights were derived? Did you analyse what sort of mistakes it made?
    - Examples of output? Anything to demonstrate unique aspects of the approach?
    - Be sure to think of tangible ways to present the results. Each figure should have a point it is trying to convey. Your figures/tables should tell a logical story from first to last.
- **Conclusion**
    - Summarise the takeaways.
- **Reflection (1 paragraph)**
    - What did you learn from this project? What do you wish you had known before you started? What would you do differently? What advice would you offer to future students embarking on this project?
- **References**
    - Be sure to cite and add references (at least THREE (3) references to others' work) for any ideas, data, or tools you are using or building from.
    - **All figures, quotes, or rephrases from articles, websites, and research papers (anyone else) should be cited, or you may receive a 0 for plagiarism.**
- **Format**: refer to the Springer-Nature article format (folder name: format_report).

GRADING RUBRICS:

Your final project will be graded as the following:

- **Task definition**: is the task precisely defined, and does the formulation make sense?
- **Approach**: was a baseline, an oracle, and an advanced method described clearly, well justified, and tested?
- **Data and experiments**: have you explained the data clearly, performed systematic experiments, and reported concrete results?
- **Analysis**: did you interpret the results and explain why things worked (or did not work) the way they did? Do you show concrete examples?
- **Extra credit**: does the project present interesting, complicated datasets, programming, and novel ideas (i.e., would this be publishable at a good conference)?

Policy:

All grading of deliverables will be based on standards indicated for each deliverable. Deliverables may not be turned in late, and no cheating! For this class, cheating will include plagiarism (using the writings of another without proper citation), copying of another (either current or past student's work), working with another on individually assigned work, or in any other way presenting as one's work that which is not entirely one's work. The occurrence of plagiarism will result in removal from the course with a failing grade.