Assignment 2

2024 September Semester

CSC3034 Computational Intelligence

1 Instructions

1. Form a group of 3 to 4 members.

   The same group from Assignment 1 may be maintained, but not compulsory; inform me if there is any changes in your group so I can assign the submission correctly

2. Construct a neural network on a real-world dataset.
3. Discuss one type of hybrid intelligent system that can be applied as modifications to improve this neural network with the chosen dataset.
4. Submit your code and report by 17 December 2024 23:59.

2 Tasks

2.1 Neural network construction with a real-world dataset

1. Choose a real-world dataset that is available online. You can obtain your dataset from Kaggle, UCI Machine Learning Repository, or other sources that you can find.
2. Understand the dataset.
3. Identify the purpose of applying a neural network on the dataset.
4. Discuss the neural network architecture to be constructed.
5. Construct, train, and test the neural network on the dataset.
6. Discuss the results.

2.2 Hybrid intelligent system implementation

1. Select one type of hybrid intelligent system that modifies the neural network to be used on the same dataset.
2. Discuss the purpose of implementing the hybrid intelligent system.
3. Describe how you would implement the hybrid intelligent systems.

Notes

You do not need to implement the hybrid intelligent system in code.

2.3 Report specification

The content of your report should be less than 10 pages. The report should include

1. the source of the dataset,

2. the description of the dataset,
3. the purpose of applying a neural network (what do you want to achieve with a neural network?),
4. the architecture of the neural network (how many layers of neurons you are using? Are you using a feedforward or a recurrent?),
5. the justification on the architecture (why do you choose the different parameters of the architecture?),
6. the implementation of the training of the neural network (how do you split the data? how do you determine the stopping criteria?),
7. the discussion on the results (what do the results tell you about the neural network?)
8. the type of hybrid intelligent system you have selected as modification to the neural network,
9. the purpose of the modification with the hybrid intelligent system (what can the hybrid system do that the neural network cannot?), and
10. the description on how the hybrid intelligent system may be applied on the dataset.

Notes

These questions are provided to help you to decide what to include in the report. They are not exhaustive and should not limit your content.

3 Marks distribution

This assignment contributes to 10% of the final grade, consists of two components, report (70%) and code (30%).

Table 1: Rubrics for Report (70%)

Criteria	Needs Improvement (0 - 20)	Adequate (20-50)	Good (50-80)	Excellent (80-100)
Data Description 10%	Minimal or unclear description of the dataset with little to no explanation of sources, features, or preprocessing.	Basic description of the dataset, with some explanation of sources and preprocessing steps.	Thorough explanation of the dataset with adequate details on sources, preprocessing, features, and key statistics.	Comprehensive and accurate description of the dataset, including data sources, preprocessing steps, key features, and relevant statistics.
Neural Network Application Purpose 10%	Vague or unclear purpose for applying the neural network. Little to no rationale provided.	The purpose of applying a neural network is mentioned but lacks strong justification or connection to project goals.	The purpose of the neural network is well stated and connected to the project's goals, with a reasonable explanation for its selection.	Clearly articulates the purpose of applying a neural network, linking it explicitly to the project's goals and dataset characteristics. Provides a well-reasoned justification for the chosen approach.

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Table 1: Rubrics for Report (70%) (Continued)

Neural Network Design Explanation 10%	Poorly explained or insufficiently described neural network with minimal justification for design choices.	Basic explanation of the neural network design with limited details on architecture, layers, and hyperparameters. Justification for choices is minimal or unclear.	Well-structured neural network design explanation with explanations for architectural choices and hyperparameters, though minor details may be missing.	Detailed explanation of the neural network design, including architecture, layers, activation functions, and hyperparameters. Provides thorough justification for design choices and addresses challenges.
Result Evaluation 20%	Inadequate evaluation with limited metrics and minimal analysis of model performance.	Basic evaluation using some metrics, but limited analysis or comparisons to benchmarks.	Effective evaluation with appropriate metrics and some comparisons to benchmarks. Analysis of performance is present but may be less comprehensive.	Comprehensive evaluation of the results using appropriate metrics (e.g., accuracy, loss). Analysis includes comparisons to benchmarks, discussions of model performance, strengths, and weaknesses.
Hybrid Intelligent System Discussion 20%	Little or no discussion of hybrid systems or how components integrate.	Basic discussion of hybrid systems with limited detail on integration or benefits.	Good discussion of the hybrid intelligent system with some details on the integration of neural networks and other components.	In-depth discussion of how the neural network integrates with other AI/ML components to form a hybrid intelligent system. Offers clear examples, benefits, and potential improvements.

Table 2: Rubrics for Code (30%)

Criteria	**Needs Improvement (0 - 20)**	**Adequate (20 - 50)**	**Good (50-80)**	**Excellen (80-100)**
Code Functionality and Correctness 10%	Code fails to run or produces major errors that prevent functional output. Neural network implementation is incomplete or largely incorrect.	Code runs but may contain bugs, errors, or inconsistencies that impact output accuracy. Some parts of the neural network are implemented correctly, but others show errors or lack expected behavior.	Code runs with minor issues or occasional warnings that do not significantly affect functionality. Most aspects of the neural network implementation are correct and effective.	Code runs without errors and produces correct outputs as intended. Demonstrates a high degree of accuracy in achieving the specified task with proper implementation of neural network layers, functions, and parameters.
System Output Display and Description 20%	Output is poorly presented with limited or no descriptions, making it difficult for users to interpret. No or minimal visual aids are provided, and little context is offered to explain the results.	Output is somewhat clear but may lack comprehensive display elements or detailed descriptions. Interpretation of the results requires effort, and context is only partially provided, limiting user understanding.	Output is generally well-presented and mostly user-friendly, with some descriptive explanations and visual aids. Provides sufficient context for users to understand the main outcomes, but lacks in-depth analysis or additional clarifying details.	Output is presented in a clear, user-friendly format that facilitates easy interpretation. Includes detailed descriptions and visualizations (e.g., charts, graphs) to effectively explain the outcomes. Contextual explanations and insights are provided, ensuring a thorough understanding of the results.