Universiteit van Amsterdam

Projectplan

How good of an exercise filter are LNNs?

24 november 2024

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1 Task Description

The aim of this project is to evaluate the classification capabilities of Logic Neural Networks (LNNs) when required to incorporate and reason about multiple variables and parameters. Further details about the dataset and experimental setup are provided in the Dataset section of the Project Plan.
In more technical terms, the study will focus on: ässessing how well LNNs can infer relationships between basic demographic and physiological data."
The primary research question is: How effectively can LNNs classify and generate optimal workout recommendations based on these types of data? Secondary questions could include: What are the most influential input features for achieving accurate classifications? and How does the performance of LNNs compare to alternative machine learning models for this task?

2 Dataset Description

The Gym Members Exercise Dataset Khorosani 2024 October 6 contains 15 features related to gym members' demographics, physical attributes, workout activities, and health metrics. The dataset supports tasks such as classification (e.g., predicting workout type) and optimization (e.g., suggesting an ideal workout plan).

- Input Features: Age, Gender, Weight, Height, BMI, Experience Level, Fat Percentage, Water Intake.
- Target Variables: Workout Type, Session Duration, Calories Burned.

Age, Gender, and Weight can serve as a baseline for input features, which will generate initial predictions. Additional parameters Provide opportunities to explore how incorporating more data impacts the model's performance and eventual result.

3 Model Identification and Justification

The proposed model is a Logic Neural Network (LNN) for classification tasks, reason being:

- Logical Reasoning: LNNs integrate symbolic reasoning with neural networks, enabling them to make decisions based on interpretable rules derived from input features.
- Flexibility: LNNs can handle structured data effectively and provide insights into feature importance, unlike black-box neural networks.

4 Expected Outcomes

This study will assess the performance of Logic Neural Networks (LNNs) in classifying workout types based on demographic and physiological features, such as Age, Gender, Weight, BMI, and Fat Percentage. It will explore the most influential features for classification and how these data points contribute to predictions. The study will also benchmark LNNs against other models, including Random Forests and Multi-Layer Perceptrons (MLPs), focusing on the explainability and interpretability of the models. Ultimately, the research aims to highlight the potential of neural-symbolic AI models like LNNs for decision-making tasks involving structured and interpretable data.

5 Feasibility

The project is technically feasible, with a clean and well-structured dataset that is suitable for both LNNs and baseline models. LNN frameworks, such as IBM's Neuro-Symbolic AI toolkit and Logic Tensor Networks, are accessible and capable of handling the task. The dataset is manageable using standard computational resources, including local machines with GPUs or cloud services. The project scope is focused on a clear, achievable classification task, with opportunities for deeper analysis.

6 Presentation including appropriate citations

A few rules of the model could be something like these:

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IF Age < 30 THEN Workout_Type = "HIIT"
IF Age >= 30 AND Age < 50 THEN Workout_Type = "Cardio"
IF Age >= 50 THEN Workout_Type = "Yoga"

IF Gender = "Male" AND BMI > 25 THEN Workout_Type = "Strength"
IF Gender = "Female" AND Fat_Percentage > 30 THEN Workout_Type = "Yoga"
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Referenties

Khorosani, V (2024 October 6). *Gym members exercise dataset*. URL: https://www.kaggle.com/datasets/valakhorasani/gym-members-exercise-dataset.