CS5720 Neural Network & Deep Learning
Project Proposal

BREAST CANCER CLASSIFICATION
USING NEURAL NETWORKS

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PROBLEM STATEMENT:

- Breast cancer, a global health challenge, demands early detection for effective treatment. Current classification methods lack precision, especially in recognizing subtle tumor variations. To overcome this, the challenge is to create a robust neural network-based system. Neural networks offer nuanced pattern recognition, vital for distinguishing between benign and malignant tumors.

OBJECTIVES:

- Utilization of neural networks for breast cancer classification.
- Implementation of a predictive system for real-time tumor classification.
- Assessment of model performance using accuracy and loss metrics.
- Exploration of the impact of data standardization on model training.
- Evaluation of the proposed framework in comparison to existing methodologies.

METHODOLOGY:

- **Data Collection and Processing**: Utilizing the Breast Cancer Wisconsin dataset, ensuring it's loaded, processed, and transformed into a Pandas DataFrame.
- **Data Standardization**: Standardizing features with the StandardScaler from scikit-learn to ensure consistent data distribution, a crucial step for many machine learning algorithms.
- **Train-Test Split**: Dividing the dataset into training and testing sets. This is fundamental for training the model on one set of data and evaluating its performance on another, unseen set.

- **Neural Network Architecture**: Designing a neural network with input, hidden, and output layers using TensorFlow and Keras. This architecture is the core of the system for learning and making predictions.
- **Model Compilation and Training:** Compiling the model with specific settings, including the Adam optimizer and sparse categorical cross-entropy loss function. Training the model involves feeding it the training data and adjusting the internal parameters to improve performance.
- **Results and Evaluation**: Visualizing and evaluating model accuracy and loss. Additionally, assessing the model's performance on the test set to ensure it generalizes well to new, unseen data. The implementation of a predictive system for real-time tumor classification indicates the practical application of the developed model.

RELATED WORK:

- Existing research has explored traditional methods for breast cancer classification, incorporating statistical approaches and rule-based systems, highlighting both their strengths and limitations.
- A thorough review of literature reveals a variety of machine learning techniques applied to breast cancer classification. Previous studies have utilized different algorithms, feature selection methods, and performance metrics to achieve classification goals.
- Specific focus on neural networks in breast cancer diagnosis has demonstrated diverse architectures. Understanding how these networks handle data and contribute to diagnostic accuracy is essential for the current project.

ROLES AND RESPONSIBILITES:

- Explore and understand the breast cancer dataset.
- Preprocess the data, including handling missing values, checking data distribution, and scaling features.
- Develop and implement the neural network architecture using TensorFlow and Keras.
- Configure the layers of the neural network based on the problem requirements.
- Choose appropriate activation functions, loss functions, and optimizers for the neural network.
- Compile and train the neural network using the training data.
- Monitor and visualize the training process, including accuracy and loss metrics.
- Evaluate the performance of the trained model on the test set.
- Provide domain expertise on breast cancer and related medical concepts.
- Collaborate with the data scientist to interpret features and statistical measures in the dataset.
- Validate the relevance and accuracy of the features selected for the model.

RESULTS:

- The research demonstrates the successful application of neural networks for breast cancer classification, showcasing the potential of advanced machine learning techniques.
- The proposed framework, encompassing data preprocessing, model training, and the implementation of a predictive system, yields promising results in breast cancer classification.

- This study contributes to ongoing efforts to improve breast cancer diagnosis by leveraging advanced machine learning, addressing the need for more sophisticated and accurate classification methods.

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