**Pimpri Chinchwad Education Trust's**

# Pimpri Chinchwad College of Engineering

## Major Project Synopsis

**Department:** Computer Engg. **Academic Year:** 2024 -2025 **Semester:** I
**Year:** B. Tech. (Scheme A) **Div: B** **Group ID:GB13** **Date:** 27-August-2024

**Problem Statement:** Brain Tumour Classification with Quantum-Augmented Deep Learning Model

**Project Domain and SIG:** Biomedical Applications and Soft Computing (BASC)

**Whether it is inclined towards Either of following National thrust areas or others:** HEALTH & Hygiene

**Team Members:**

| PRN No | Name of Student | Mail-id | Contact No. | Signature |
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**Sponsorship if any:**

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**Name of External Guide:** Dr. Ghangale Abhijeet balkrishna

**Abstract:**
The accurate classification of brain tumors in medical imaging is vital for timely diagnosis and effective treatment planning. Traditional methods of manual interpretation by radiologists are labor-intensive and prone to error, leading to potential delays and inaccuracies. Our project addresses these challenges by integrating Quantum-Augmented Deep Learning models, which combine the strengths of classical deep learning techniques with quantum computing principles. This approach aims to improve the precision and efficiency of brain tumor classification, providing a faster and more reliable diagnostic tool for healthcare professionals. By leveraging Quantum Transfer Learning (QTL), our model seeks to overcome limitations of conventional methods and enhance diagnostic accuracy.

**Related Work:**

Previous research has explored various machine learning techniques for medical imaging, with a focus on convolutional neural networks (CNNs) and transfer learning. However, integrating quantum computing into these models remains underexplored. Our work builds on these foundational methods, incorporating quantum principles to address limitations in existing approaches and enhance classification performance.

**Innovative concept and relevance of the topic:**

The integration of quantum computing with deep learning represents a significant advancement in medical image analysis. By employing Quantum Transfer Learning, our project pioneers the use of quantum algorithms to augment classical models, offering a novel approach to overcoming data limitations and computational challenges. This innovation has the potential to substantially improve the accuracy and efficiency of medical diagnostics.

**Market potential and competitive advantage:**

The healthcare industry increasingly relies on advanced technologies for accurate diagnostics. Our quantum-augmented model offers a competitive advantage by providing superior classification accuracy compared to traditional machine learning methods. This technological edge can lead to faster diagnostic processes, reduced error rates, and improved patient outcomes, making it a valuable tool for medical imaging and diagnostics.

**Project Objectives: Industry/ Product/ Research/Societal (Min 3)**

1. To evaluate the feasibility and effectiveness of Quantum Transfer Learning (QTL) in brain tumor classification.
2. To develop a hybrid model combining classical deep learning techniques with quantum computing principles for improved diagnostic accuracy.
3. To assess the performance of the QTL-based model against traditional and state-of-the-art methods in medical imaging.

**Technical Details (Platform and languages):**
The project utilizes a hybrid approach integrating classical deep learning frameworks, such as TensorFlow or PyTorch, with quantum computing libraries, like PennyLane. The model will be implemented using Python, leveraging quantum circuits and variational algorithms for classification tasks.

**Technical Key Words (Ref ACM Keywords): (Ref web: www.acm.org/about/class/ccs98-html)**

- Quantum Computing
- Deep Learning
- Medical Imaging
- Brain Tumour Classification
- Quantum Transfer Learning
- Hybrid Machine Learning

**Relevant Mathematical Models Associated with the Project:**

- Quantum Computing Algorithms
- Convolutional Neural Networks (CNNs)
- Variational Quantum Circuits
- Optimization Techniques (e.g., Gradient Descent)

**Targets from project: (Discuss with guide and tick)**

-Paid Consultancy project
-Sponsored Project
-Scopus/SCI Paper Publication
-Patent
-Project competition and awards

**References: List of Conference/Journal Papers supporting project idea (at least 10 papers + white papers or web references)**


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7. Paul, S., Ahad, D. M. T. and Hasan, M. M. (2022). Brain can cer segmentation using yolov5 deep neural network. arXiv preprint arXiv:2212.13599.

8. Guan, Y., Aamir, M., Rahman, Z., Ali, A., Abro, W. A., Dayo, Z. A., ... and Hu, Z. (2021). A framework for efficient brain tumor classification using MRI images.

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11. Ayadi, W., Elhamzi, W., Charfi, I., and Atri, M. (2021). Deep CNN for brain tumor classification. Neural processing letters, 53, 671-700.

12. Abd El Kader, I., Xu, G., Shuai, Z., Saminu, S., Javaid, I., and Salim Ahmad, I. (2021). Differential deep convolutional neural network model for brain tumor classification. Brain Sciences, 11(3), 352.


**(Name and Sign of Student(s))** **(Name and signature of Project Guide)**

**Dr. Asmita manna**