**CHAPTER 1**

**INTRODUCTION**

**1.1 Objective of Internship**

The objective of this internship is to gain hands-on experience in the development and implementation of advanced deep learning algorithms for biomedical signal processing, with a focus on sleep stage classification using single-channel EEG data. Building on the foundation of the research paper "An Attention-Based Deep Learning Approach for Sleep Stage Classification with Single-Channel EEG," this internship aims to provide the intern with a comprehensive understanding of the methodologies and techniques involved in the design and optimization of attention-based deep learning models.

Here are some few key points about the objective:

1. **Understanding Deep Learning Architectures:**
   * Gain in-depth knowledge of convolutional neural networks (CNNs) and their application in feature extraction from EEG signals.
   * Study the principles of multi-resolution CNNs (MRCNN) and adaptive feature recalibration (AFR) to enhance the quality of extracted features.
2. **Exploring Attention Mechanisms:**
   * Learn about temporal context encoding (TCE) and multi-head attention mechanisms for capturing temporal dependencies in EEG data.
   * Understand the deployment of causal convolutions within attention mechanisms to model temporal relations effectively.
3. **Implementing the AttnSleep Model:**
   * Implement the AttnSleep model architecture for sleep stage classification, leveraging the concepts of MRCNN, AFR, and TCE.
   * Conduct experiments using public EEG datasets to evaluate the performance of the AttnSleep model.
4. **Handling Data Imbalance:**
   * Study and implement class-aware loss functions to address the issue of class imbalance in sleep stage classification tasks.
   * Explore oversampling techniques and their impact on model training and performance.