INTRODUCTION

Knee osteoarthritis (OA) is a degenerative joint disease that presents many challenges in diagnosis and treatment. Accurate assessment of OA severity is crucial for better intervention and guidance. This project aims to develop a deep learning-based system for the segmentation of medical images. We will use CNN (Convolutional Neural Network), a class of deep learning models renowned for their exceptional image processing capabilities.

The project will use a dataset of X-ray images of knees to train and validate the CNN-based segmentation model. Through training with annotated images, the model will learn to identify and delineate relevant structures within the knee joint.

LITERATURE SURVEY

1. Emergence of Deep Learning in Knee Osteoarthritis Diagnosis

Osteoarthritis (OA) is one of the most prevalent degenerative musculoskeletal diseases. This study reviews the evolution of deep learning from 2D to 3D as a promising tool for computer-aided diagnosis for knee osteoarthritis disease. The conventional approach to diagnose osteoarthritis is by examining medical images visually where manual assessment makes it difficult to identify the slightest progression of early-onset osteoarthritis. This is where the role of artificial intelligence comes in. In conclusion, deep learning holds significant promise in the development of osteoarthritis clinical decision aid.

1. Deep learning applications in osteoarthritis imaging

Deep learning methods can detect and grade the severity of knee osteoarthritis and features of knee osteoarthritis on X-rays with similar diagnostic performance as human readers. DL approaches have been shown to achieve higher accuracy for fully automated segmentation of knee cartilage and bone than currently used model-based and atlas-based methods with substantial reductions in segmentation times.

1. Clinical evaluation of fully automated thigh muscle and adipose tissue segmentation using a U-Net deep learning architecture in context of osteoarthritic knee pain

This paper discusses about the muscle segmentation based on a U-Net is shown to be accurate and can thus be applied to fully automated evaluation of large datasets considerably faster (< 1 s) than for current (semi-) automated (3–6 min) or manual segmentation techniques (60–90 min).

METHODOLOGY

**1. Data Collection and Preparation:**

Gather an extensive dataset of medical images of knees MRI.

The Osteoarthritis Initiative (OAI) and the Multicenter Osteoarthritis Study (MOST) are

prominent sources.

**2. Preprocessing:**

Normalise the data to ensure consistency.

Apply data augmentation techniques like rotation and translation to prevent overfitting

and increase the distinctiveness of the training data.

Resize the images to the fixed size to ensure uniformity amongst datasets.

**3. Model training:**

Choose a suitable model for segmentation.

U-Net is the widely used deep learning architecture for Biomedical Image Segmentation.

It is also a better choice because of its encoder-decoder structure that preserves spatial

information.

**4. Evaluation:**

Evaluate the performance using metrics like precision, recall, and F1 score.

Perform cross-validations to assess the model’s stability and robustness.

**5. Implementation and deployment:**

Develop an inference pipeline that preprocesses input images, applies the trained CNN

model, and post-processes the segmentation output.

REFERENCES

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