Using Deep Learning Models to Predict and Locate Tumors in Liver Cancer CT Scans

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ABSTRACT

- Liver cancer has a high mortality rate and poor prognosis due to late-stage diagnosis.
- Current diagnostic techniques primarily rely on manual interpretation of CT scans, which is time-consuming and prone to human error.
- This project aims to enhance early detection and diagnosis of liver cancer by developing a machine learning model capable of accurately identifying liver tumors in CT scans.
- The proposed model uses advanced image processing techniques to analyze and segment liver tissues, improving the accuracy of tumor detection.

INTRODUCTION

- **Scientific Premise**: Liver cancer diagnosis is challenging due to the subtlety of early-stage tumors and the reliance on manual CT scan analysis.
- **Objective**: The project focuses on developing a machine learning model using deep learning algorithms to detect liver tumors in CT scans, thereby improving early detection rates.

METHODS

Data Collection and Preparation:
- Data was collected from the Medical Decathlon database, including liver CT scans and corresponding tumor labels.
- Images were preprocessed using a custom data generator, which included normalization, resizing to 512x512 pixels, and random slice selection for diverse training data.

Model Development:
- A custom U-Net model was developed to segment and identify tumors in 2D CT scan images.
- **Encoder**: Captures important features by compressing the image.
- **Bottleneck**: Processes crucial features to focus on key aspects of the image.
- **Decoder**: Reconstructs the image, highlighting tumor regions using the encoded features.

Training and Optimization:
- The model was trained with a balanced loss function that considers both pixel accuracy and tumor segmentation performance.
- Performance was validated using metrics such as the Dice coefficient, precision, and recall.

RESULTS

- The model achieved moderate success in detecting liver tumors, identifying some tumorous regions with reasonable accuracy.
- Validation and testing showed potential but also highlighted the need for further optimization and additional training data to enhance the model's reliability.

Data

Source: The liver CT scan images and corresponding tumor annotations were sourced from the Medical Decathlon dataset. This dataset is widely recognized for its diversity and the quality of its medical imaging data.

Composition:

The dataset consists of liver CT scans from a variety of patients, providing a broad spectrum of cases, including different stages of liver cancer.

In total there is aroudnd 150 ct scans used from trained each having hundred of slices which we can use to train the model .

Each scan is accompanied by detailed annotations marking the presence and location of tumors, making it suitable for supervised learning tasks such as segmentation and detection.

CONCLUSION

- The project successfully developed a machine learning model for detecting liver tumors in CT scans.
- While the model shows promise, further optimization and additional training are required to enhance its accuracy and clinical applicability.
- Continued development could lead to more reliable and efficient tools for early liver cancer detection and patient monitoring.

References

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