# Proposal Defense Document

## Group No. 38

## Edema Detection Using Deep Learning

## BS Computer Science, Batch 2020S

**Supervised by:**
**Dr. Waleej Haider**

**Assistant Professor**

**Submitted by:**


| | |
|---|---|
| 2020S-CS -097 | Muhammad Shayan |
| 2020S-CS-121 | Rose Ulfat |
| 2020S-CS-123 | Syeda Khizran Fatima |
| 2020S-CS-132 | Ilma Ameen |

**Department of Computer Science & Information Technology**
**Sir Syed University of Engineering & Technology**
**University Road, Karachi 75300**
http://www.ssuet.edu.pk

# 1. Project Summary/Abstract:

The Abstract of this dissertation is to explore various deep learning techniques that can be used to implement a system which learns how to detect edema. Edema is swelling caused by too much fluid trapped in the body's tissues. Edema can affect any part of the body and making it one of the deadliest diseases if no one diagnosis it early and left untreated, it can lead to severe conditions. The systems that can learn to detect edema on their own could help reduce the number of incorrect interpretations and detect the disease. So through this we can detect the disease early and also provides it solution by suggesting the medicine according to that particular type of edema. To implement a deep learning solution for edema detection, a dataset of medical images containing both normal and edematous tissues is collected. The dataset is then labeled so that the model can learn to distinguish between normal and edematous tissue. We perform Edema detection through deep learning involves using convolutional neural networks (CNNs).

# 2. Problem Statement:

Edema is a medical condition that occurs when excess fluid builds up in the body's tissues, causing swelling and inflammation. Edema can be caused by a variety of factors, including heart failure, kidney disease, liver disease, and chronic venous insufficiency.

Early detection allows for prompt intervention and treatment, which can prevent the condition from worsening and potentially causing more serious health problems. It will also help peoples living in rural areas to examine their selves through this application. Also, this application help the doctors to examine the disease in the early stage without going through a lot of difficult procedure

# 3. Project Objective:

In the end of the project of edema detection using deep learning we are planning to develop a robust and accurate system application for automatic detection of edema regions in using image processing. The system should be able to accurately segment the edema regions and provide a quantitative measure of the extent and severity of edema type.

The successful completion of the project will provide significant benefits for both clinicians and patients. Clinicians will be able to make more accurate and timely diagnoses, leading to improved treatment decisions and better patient outcomes. Patients will benefit from more personalized treatment plans and potentially reduced healthcare costs.

4. **Literature Review with Comparative Analysis:**

# Literature Review :

Existing Systems Since no prior work in making an application having a deep learning model implemented in it to detect edema is done yet therefore, we cannot compare our solution with any application, but it could be compared with existing proposed deep learning models such as:

**Title: Using deep learning models to analyze the cerebral edema complication caused by radiotherapy in patients with intracranial tumor. [1]**

## Description:

In this paper, researchers, due to GPU memory limitations, the 2D U-Net model can process complete slices at one time, while the 3D convolution system can only process small blocks that cover a small part of the 3D volume. Therefore, a 2D-based network is used. In addition, they proposed a fully automated brain tumor segmentation method, which was developed using a deep convolutional network based on U-Net. Their method was evaluated on Multimodal Brain Tumor Image Segmentation (BRATS 2015) dataset. The results of cross-validation show that the method can effectively obtain promising segmentation. Compared with our study, this result verifies that similar methods have the same excellent results. We still hope to have more cases in future studies, so that the explanation of the complications of cerebral edema caused by radiotherapy in patients with intracranial tumors can be clearer.

**Title: SwellFit: Developing A Wearable Sensor for Monitoring Peripheral Edema. [2]**

## Description:

Peripheral edema is a swelling of the legs, feet, or hands due to the accumulation of excessive fluid in the tissues.

As a systematic approach to assessing peripheral edema, we develop SwellFit, an experimental prototype of a novel wearable technology that monitors peripheral edema by tracking changes in ankle curvature. Through a series of proof-of-concept experiments, we demonstrate that SwellFit detects ankle swelling even in the presence of substantial noise in the raw sensor readings.

**Title: Diabetic Macular Edema Detection. [3]**

## Description:

Diabetic macular edema (DME) is a common cause of vision impairment and blindness in patients with diabetes. We developed an end-to-end deep fusion model for DME classification and hard exudate (HE) detection. Based on the architecture of fusion model, we also applied a dual model which included an independent classifier and object detector

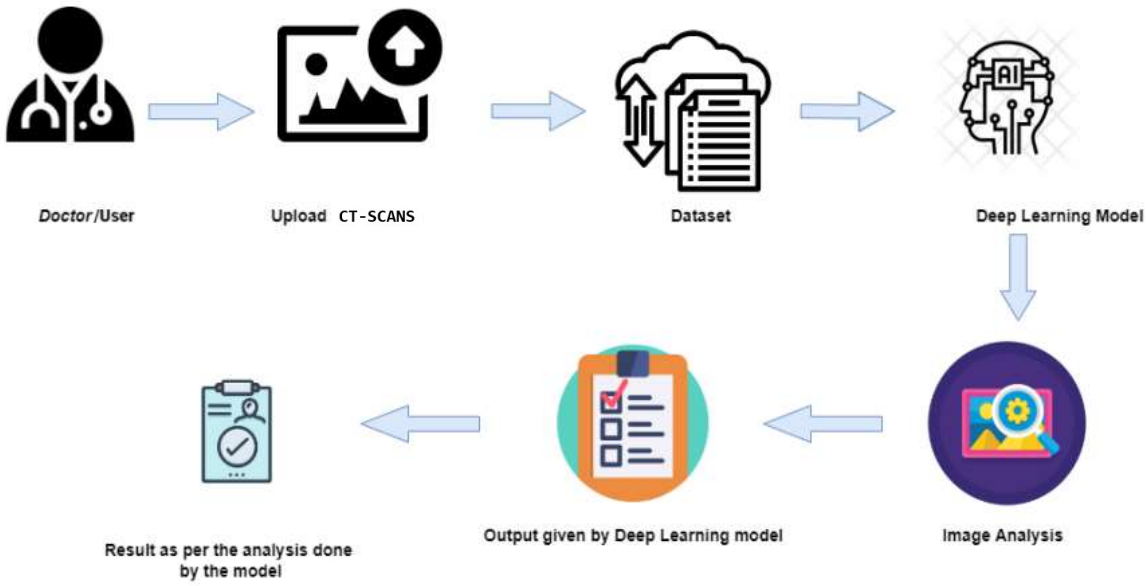
to perform these two tasks separately. We used 35,001 annotated fundus images from three hospitals between 2007 and 2018 in Taiwan to create a private dataset. Clinically, this system could be applied to diabetic eye screening to improve the interpretation of fundus imaging in patients with DME.

## COMPARATIVE ANALYSIS TABLE :

| FEATURES | CEREBRAL EDEMA | SWELLFIT | Diabetic Macular Edema Detection | EDEMA SENSE |
|---|---|---|---|---|
| Desktop Application | ✗ | ✓ | ✗ | ✓ |
| CT-SCANS | ✗ | ✗ | ✓ | ✓ |
| MRI-SCANS | ✓ | ✗ | ✓ | ✓ |
| Dataset Conversion in 2D | ✗ | ✗ | ✗ | ✓ |
| Convenience | ✗ | ✗ | ✗ | ✓ |
| Time Efficient | ✗ | ✓ | ✗ | ✓ |

5. **Project Development Methodology:**

## System Architecture Diagram :




# 6. Benefits of Project:

Early detection of edema is necessary to provide early intervention and treatment, which can improve patient outcomes and reduce the risk of serious complications. Deep learning can provide an effective solution for edema detection and segmentation, which can help medical professionals to detect edema in its early stages and to develop personalized treatment plans for patients especially doctors and people who lives in a rural area can get a lot of benefit through it.

For example, if edema is detected in the early stages in patients with heart failure, appropriate medications can be prescribed to manage the condition and prevent the development of further complications such as pulmonary edema.

## 7. Project Key Milestones with Technical Details Of Final Deliverables:

| Project time line | Milestones | Deliverables |
|---|---|---|
| Month 1 | Research about the disease | Project Proposal Document |
| Month 2 | Research about Deep Learning Algorithms | Project Proposal Document |
| Month 3 | Learn Fundamentals of DL | DL Model on Example Dataset |

| | | |
|---|---|---|
| Month 4 | Data Collection by Physically visiting Hospitals | Raw Data for our model |
| Month 5 | Data Cleaning and Filteration | Dataset for our Model |
| Month 6 | Training the Model on our Dataset | DL Parameters with Initial accuracy |
| Month 7 | Design and Development of our Cross Platform Application | Web App / Mobile App |
| Month 8 | Improving the Accuracy of our DL Model | DL Parameters with Improved Accuracy |
| Month 9 | Integration of Model with the backend of Application | Web App / Mobile App with the Model running |
| Month 10 | Testing and Debugging of Application | Tested Web App / Mobile App with the Model running |
| Month 11 | Deployment | **Live** Web App / Mobile App |
| Month 12 | FYP Report Writing | FYP Report |

## 8. Costing:

| S.No | Project Expenditure | Cost in Rupees |
|---|---|---|
| **1** | **Software Tools and API** | |
| | • Anaconda<br>• Jupyter Notebook<br>• Streamlit<br>• NumPy<br>• PyTorch<br>• Matplotlib | **Sub Total: Rs. None** |
| | **Sub Total** | **None** |
| 2 | **Domain Name and Hosting** | |
| | Domain Name | 2000 |
| | Hosting | 8000 |
| | **Sub Total** | **10000** |
| 3 | **Hardware and Networking Cost** | |
| | • GTX 1050 Ti | 30000 |
| | • Power Supply 300w | 2000 |
| | • Developing cost and other | 50000 |
| | **Sub Total** | **82,000** |
| | **Grand Total** | **92,000** |

## 9. Work Division

Clear work division among group members to be shown.

| Name of Tasks / Work | Name of Group Member |
|---|---|
| Mobile Application | Rose,Khizran,Ilma , Shayan |
| Web Application/ backend | Ilma, Shayan,Rose,khizran |
| UI/UX, Frontend/documentation | Ilma,Rose,Shayan,Khizran |

## 10. References:


[1] Chao, Pei-Ju Chang, Liyun Kang, Chen-Lin Lin, Chin-Hsueh Shieh, Chin-Shiuh Wu, Jia-Ming Tseng, Chin-Dar Tsai, I-Hsing Hsu, Hsuan-Chih Huang, Yu-Jie Lee, Tsair-Fwu, *et al.* (2022) *Title: Using deep learning models to analyze the cerebral edema complication caused by radiotherapy in patients with intracranial tumor.*, *Scientific Reports*. Available at: https://www.nature.com/articles/s41598-022-05455-w(Accessed: March 21, 2023).

[2] *Harvard University* (no date). Available at: https://www.eecs.harvard.edu/~kgajos/papers/2016/skim16swellfit.pdf (Accessed: March 21, 2023).

[3] Wang, T.-Y. *et al.* (2022) *Diabetic macular edema detection using end-to-end deep fusion model and anatomical landmark visualization on an edge computing device*, *Frontiers*. Frontiers. Available at: https://www.frontiersin.org/articles/10.3389/fmed.2022.851644/full (Accessed: March 22, 2023).