# MILESTONE 2

# (LIVER TUMOR SEGMENTATION)

**Name:** Arijeet Sinha

**Roll No:** E16CSE121

**Email:** arijeet.sinha@bennett.edu.in

**Project Title:** Liver Tumor Segmentation

**Data Details:** This data contains CT Scans for liver lesions in the codalabs challenge. It consists of rough liver segmentation and accurate liver segmentation

**Source of Data/Size of Data/No. of Records/ Variety/ Authenticity of Data Etc. (2 Marks)**

- The Liver Tumor Segmentation dataset is collected from codalabs. The dataset consist of two training batches. Each batch contains files in .nii extensions.
- The size of training data batch 1 is 13.5 GB. The batch 1 data is divided into 6 batch files. Each file size is approximately 2 GB. In total , there are 62 files in this batch.
- The size of training data batch 2 is 35.5 GB. The batch 2 file is divied into 17 batch files. Each file size is approximately 2 GB.
- I have started with the training of batch 1 files in order to convert those .nii files to numpy array by preprocessing. Afterwards, I started creating a excel file for the numpy array which now contains 62 records.
- The size of training data batch 2 is 35.5 GB. The batch 2 file is divied into 17 batch files. Each file size is aprroximately 2 GB.

**User Interface Design**

**Salient Points/ How it meets the characteristics of User Centered Design etc. (2 Mark)**

**( At least 150 words and at least 4 figures of the User interface or other related figures of your project)**

This is the general User Interface Design Of Liver Tumor Segmentation.

This Graphical User Interface is built using Tkinter library in python. This GUI has four functionalities namely Training Samples, Test Images, Classification and then Segmentation

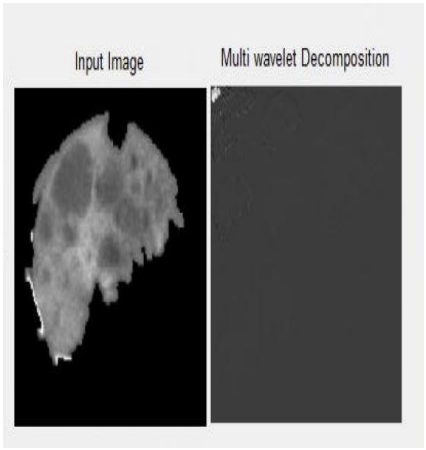
We are planning to take input from 3 ways.

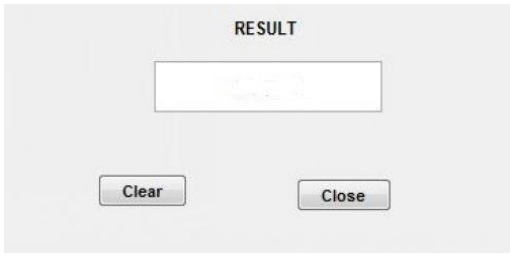
1. By taking The Training Sample which are in images. These will also convert this .nii files to numpy arrays.

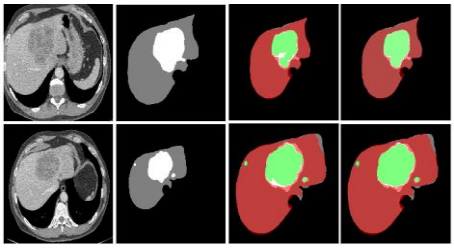
2. By allowing User to test  images while inputing and extracting features. These will also convert test numpy array files to .bmp files.

3.Then classification part is there which includes learning, classify and then segmenting livers and tumor. Here K-means clustering is used for this segmentation

The GUI is basic as of now but there are some factors which are considered while building this GUI such as while maximizing/minimizing the element locations does not lose position. There  are some dynamic elements which can adjust their size according to the window. Proper padding is provided between different element.

User Interface Design Of LiTS

**User Surveys (1 Mark)**

**Potential User 1 Feedback:**

**Name:** Akash Nishad

**Organisation:** Pristine Infosolutions, Ahmedabad

**Post:** Branch Head

**Email:** akash@pristineinfo.in

**Mobile Number:** +91-78747 57151

**Rating:** 10/10

**Feedback:** – I think it's a great idea and is use such type of application. This could increase people's health through automation and also ease the work for them. Such type of projects is really helpful for the community . Also, the purpose with which the application is built would help millions who are suffering liver diseases.

**Potential User 2 Feedback:**

**Name:** Akash Thakar

**Organisation:** Raksha Shakti University, Ahmedabad

**Post:** Teaching cum Research Associate

**Email:** tcra@rsu.ac.in

**Mobile Number:** +91-78747 57151

**Rating:** 10/10

**Feedback:** It was a great project undertaken by Arijeet Sinha. It is a remarkable field and if you carry on in this field, then you can classify the pattern broadly. This project has a big scope if implemented in Healthcare segment **.**All the very best and best wishes for your work.

**Potential User 3 Feedback:**

**Name:** Harsh Shodhan

**Organisation:** Airport School, Ahmedabad

**Post:** Teacher

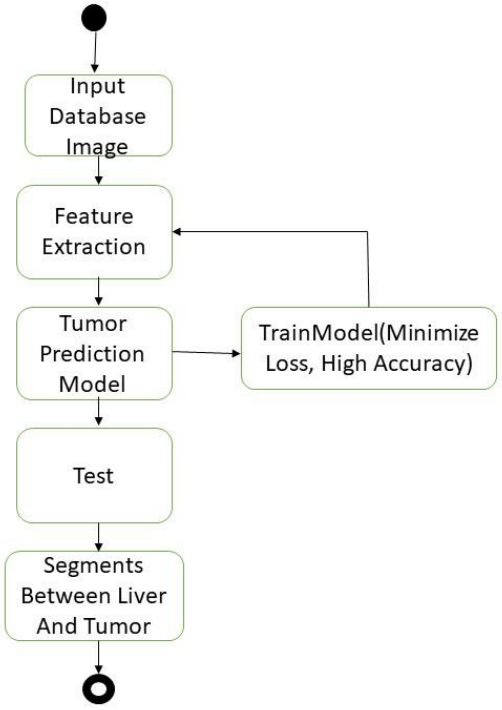
**Email:** harshshodhan59@gmail.com

**Mobile Number:** +91-89052 33638

**Rating:** 8/10

**Feedback:** It was a great initiative decided by him and I see a lot of potential in it as with advanced AI, it could be the next big innovation in the healthcare sector. Liver tumor Segmentation project has colossal potential in the therapeutic imaging space with parcel of business esteem.

**Design Documents (Overall Block Diagram/ Data Flow Diagram/ Architecture Diagram/ Solution Diagram, UML Diagram etc.) (As Applicable) (3 Marks)**




CASE DIAGRAM

**Ethical and legal/privacy/terms and conditions (3 Marks)**

By downloading or Using the application, these terms will consequently concern you – you should ensure in this manner that you read them cautiously before Using the application. You're not permitted to duplicate, or adjust the application, any piece of the application, or our trademarks in any capacity. The application itself, and all the exchange marks, copyright, database rights and other protected innovation rights identified with, despite everything it has a place with us. We focused on guaranteeing that the application is as helpful and proficient as could be allowed. Thus, we maintain whatever authority is needed to make changes to the application or to charge for its administrations, whenever and under any conditions .Certain elements of the application will require the application to have a functioning web association. The association can be Wi-Fi or given by your portable system supplier, yet we can't assume liability for the application not working at full usefulness on the

off chance that you don't approach Wi-Fi, and you don't have any of your information recompense left. In case you're using the application outside of a region with Wi-Fi, you ought to recollect that your terms of the concurrence with your portable system supplier will in any case apply. Similarly, We can't generally assume liability for the manner in which you utilize the application, for example, you have to ensure that your gadget remains charged – on the off chance that it comes up short on battery and you can't turn it on to benefit the Service, we can't acknowledge obligation. Concerning our duty regarding utilization of the application, when you're using the application, it's critical to hold up under as a main priority that despite the fact that we attempt to guarantee that it is refreshed and right consistently, we do depend on outsiders to give data to us with the goal that we can make it accessible to you. We acknowledge no obligation for any misfortune, immediate or roundabout, you experience because of depending completely on this use of the application. Sooner or later, we may wish to refresh the application. We doesn't guarantee that it will consistently refresh the application so it is pertinent to you. Notwithstanding, you guarantee to consistently acknowledge updates to the application when offered to you, We may likewise wish to quit giving the application and may end utilization of it whenever without pulling out of the end to you. Except if we reveal to you generally, upon any end, (a) the rights and licenses conceded to you in these terms will end; (b) you should quit using the application, and (if necessary) erase it from your gadget.

**feasibility study/ Business Context of the idea/ Monetization/ Opportunity Analysis ( 2 Marks)**

The ongoing progressions in Convolutional Neural Networks (CNNs)for the classification and investigation of the picture and video content using profound learning and neural systemdesigns.

Major amount of progressions have been made in tumor identification and its algorithms. These progressions owe a lot to the openly accessible datasets, for example, LiTSalgorithms are ending up promptly accessible in a suite of uses in online business, inside plan, social insurance and different areas which will build ventures in numerous spots with no supervision of people.

Following the accomplishment in tumor analysis, the next big thing would be the classification and feature extraction of the images. All the more explicitly healthcare acknowledgement and arrangement in the dataset. The essential test of Liver Tumor Segmentation analysis stays understanding the components inside a MRI images. Though an image is exclusively comprised of spatial components , experiment with model architectures such as UNet and RetinaNet etc which are much known for medical/satellite image segmentation. In addition augmentation such as rotation, flipping and color variations might be helpful in handling unseen data. However one should remember that such augmentation should be done not only for input but also for output target segmentation map also.

Hence, we think it will attract organisations to use it as it would really avoid errors and increase Health and hence building such a project will give me a good opportunity to explore many aspects in computer vision as well as building something which solves an existing problem motivates us.

**Partial Implementation/ Draft Code ( 3 Marks)**

**Give Link of Github or any other public Repository/ Web Link where your partial code is available to see**

https://github.com/Arijeet1/Liver-Tumor-Segmentation-Challenge/tree/master

**One Impressive Post on Linkedin regarding your Project ( 2 Marks)**

**( At least 100 words and one Image and 5 hashtags, Tag atleast CSE Bennett handle )**

https://www.linkedin.com/feed/update/urn:li:activity:6579832052391219200/

**Discuss your Project with at least three students of your junior batches of Bennett University and ask them how they rate your project from 1 to 10 scale. Write all three name, Roll No, email and Mobile No of those students. They should be ready to confirm if they are called on their mobile number (1+1+1 for each of three students)**

**(Positive or negative feedback will not determine the marks but the quality of the feedback will)**

**Name:** Mehul Goel

**Enrollment No.:** E17CSE124

**Email:** mg1500@bennett.edu.in

**Mobile Number:** +91-99718 11286

**Rating:** 10/10

**Feedback:** This is a very helpful project in today's world where technology is our new friend and health problems are increasing. This will be of major help for the people who can't afford high end doctors consultation due to high fee. This will be a good project from CSE perspective too. It has a great challenge. But the thing is that it will only be helpful if it has high accuracy.

**Name:** Krishna Veer Singh

**Enrollment No.:** E17CSE166

**Email:** KS7712@bennett.edu.in

**Mobile Number:** +91- 7060767678

**Rating:** /10

**Feedback:** Totally amazed with the technological advancement made in this field. It will surely help in detection of tumor at early stage and shall surely help a lot of patients. It’s a tough challenge and great project .

**Name:** Vamsi Krishna

**Enrollment No.:** E17CSE116

**Email:** vp8046@bennett.edu.in

**Mobile Number:** +91- 7060767678

**Rating:** 9.25 /10

**Feedback:** People living in the less developed countries worldwide, the disease can develop at a younger age{somewhat around 40}. By evaluating liver segmentation and tumor burden estimation, we can get foresights and better prediction.

**Get a rating from your mentor (Only One Mentor) and ask him for a rating from 1 to 10 about your consistency, progress and potential to complete the project on time. ( 3 Marks)**

**( At least 50 words feedback from each of them, Positive or negative feedback will not determine the marks but the quality of the feedback will)**

**Name –** Dr Sridhar Swaminathan

**Email ID –** sridhar.swaminathan@bennett.edu.in

**Feedback-**Liver tumor segmentation project has huge potential in the medical imaging domain with lot of commercial value. He approached me to decide the project for him. He asked me where to start the problem in which he has to select the architecture which handles small scale patterns in the tumor cells. I recommended him to experiment with model architectures such as UNet and Retina Net etc which are much known for medical/satellite image segmentation. I told him about augmentation such as rotation, flipping and color variations might be helpful in handling unseen data. Here only prediction part is left in this project. He has almost done with training and testing. My overall rating for your progress is 7.5/10. Best wishes for him.

**Discuss your project with Two Persons outside the Bennett University (apart from your family members) and and ask them how they rate your project and its progress from 1 to 10 scale. Write all three names, who they are, email and Mobile No of those. They should be ready to confirm if they are called on their mobile number (1+1 for each of two).**

**(Positive or negative feedback will not determine the marks but the quality of the feedback will)**

**Name –** Auritro Ghoshal

**Organization -** B.Sc Biotechnology from SXC Ahmedabad

**Email ID -** auritro98@gmail.com

**Mobile Number -** +91-99254 30609

**Rating –** 8.5/10

**Feedback-** The project chosen by my dear friend Mr. Arijeet Sinha is truly a wonderful one. In such a busy life, we don't take much care of our health and don't bother about getting checked up to know whether we are

healthy or not and due to those reason, we suffer from many problems which can put our lives at risk. Such is the case with Tumor and since I as person is associated with Biology background, I know how this things can be helpful to the medical experts and others.

**Name –** Rahul Datta

**Organization -** SVNIT

**Email ID -** rdatta1998@gmail.com

**Mobile Number -** +91-93282 99867

**Rating –** 10/10

**Feedback-** Great competition for this liver tumor segmentation as we are able to learn various things such as object identification which becomes challenging when the goal is to assign each mention to its entity who may or may not participate in the dialogue. It was a great experience as I came to know about various people in the world and it also increased my communication skills

**Weekwise Updates/ Diary/ Proportional achievement of stated outcomes/ Graded Functionality etc ( 2 Mark)**

**( At least 100 words in each week)**

**Week 1**

In the first week, I was busy with my internship. Along these lines, I can't do any except internships. I was involved in completing my internship report for our internship evaluation. Concerning about capstone, I understood that it was a requirement for me. Initially, my first capstone project was on gaming and I was accompanied with one of my team member of same batch. But we decided to do seperate project . So, I decided to do on one of the healthcare project which was suggested by one of our cse faculty. Doing alone is also a bit challenging for me.

**Week 2**

I have decided to do on one of the healthcare project i.e liver tumor segmentation. I found this project useful as healthcare segment is the higher need division and not the same as different segments in the businesses. Progressively number of individuals needs abnormal state of consideration and administrations. Liver sickness is a well being worry for huge piece of human population. There is an immense number of tumor patients expanding step by step. In order to take control over the illness, it can be done by identifying the early stages of liver disease because of upgrade of innovation, which has adequately improved in the field of healthcare and it enables doctors to analyze effectively.

**Week 3**

In this week, I have read and conceptualized about it and discussed it with my mentor. He sent me the link of datasets. Python based Computer Vision and Deep Learning libraries will be uses for the advancement and experimentation of the task. For that, distinctive AI and profound learning calculations is conceptualized and will be utilized. This experiment will be prepared by utilizing the Liver Tumor Segmentation Challenge Dataset and division of CT Scan pictures will be assessed. Automatic segmentation of liver tumor is the speediest way and it is increasingly exact finding and confusions gets limited during resections of tumors. Yet, this system is challenging due to heterogeneous and diffusive shape.

**Week 4**

This Liver Tumor Segmentation Dataset is collected from codalab. This training dataset is divided into 2 batches. Each batches contains files in the form of .nii. These files are converted into numpy arrays by preprocessing the dataset . This will involve collection of images from database and preprocessing them, and extracting features. Data preprocessing is very much challenging which is extremely large and require a lot of resources and computing power as these files size are in GB. Also loading time of each image will take more time. In parallel, I also gone through some of the research papers and at the same time, we also have to complete the documentation of milestone 1.

**Week 5**

Resources required for this project are just the dataset, which is available at codalabs, programming and creating model using google colab and a personal PC. These are very little requirements which have already been taken into the consideration while choosing the capstone project. All of these have been arranged before switching to the project. Apparatuses, for example, Anaconda Python, and libraries, for example, OpenCV, Tensorflow, numpy, pandas, cv2, os and Keras will be used for this procedure. Then I discussed with my mentor regarding Convolution Neural Network model used in this particular task. Then I went through those models used in this project.

**Week 6**

In this week, for this segmentation task, two architectures are used- which are U Net and Vnet, which makes the image segmentation process. Our guide told me about augmentation such as rotation, flipping and color variations might be helpful in handling unseen data. Latest research papers for activity acknowledgment in light of the fact that these structures don't manage worldly includes in Lits Databse, (for example, Faster -RCNN). These paper shows low Recall value when the dataset is prepared on the great model when contrasted with Faster-RCNN.

**Week 7**

Another documentation of 2nd milestone is evaluated this week. In this week we expected to take criticism from various individuals who can recipient of the venture. We likewise need to compose week shrewd arranging, terms and conditions, LinkedIn post, GitHub code. We additionally have midterm assessment this week so we couldn't work more on project.

**Week Wise Plan for the remaining time to complete the Project ( 2 Mark)**

**Week 8**

In this week began to work upon the execution of the task like training the model on dataset and testing it on testing dataset. We will attempt to improve the model. For measurements we are thinking about misfortune and exactness of the model. We improve the model dependent on these parameters. We are likewise taking a shot at the extent of ongoing examination of the model.

**Week 9**

I will attempt do ongoing Testing and continuous checking on RMS value and coordinate it with our activity acknowledgment framework. I will begin to do testing on our last project and taking criticism from tutor. Along with, I will be doing with the last documentation which includes videos, Presentation.

**Week 10**

In this week, here will take a shot at improving the Recall Value of our project and will test it with a few test information. Will chip away at concluding our Project. Will make sense of if there are any mistakes and troubleshoot them. Will attempt to add more activities to the model and will testing our information with remaining data and will likewise attempt to portion various activities in a solitary edge so they can be perceived independently and likewise guarantee that it is working flawlessly in the continuous encompassing and request that our guide tell any more headways if any be finished.

**Week 11**

I am almost done with the venture. Results are precise. According to the example information with great exactness dependent on standard outcomes. Last documentation is finished and I will introduce our Project thought in the pending week.