ANKARA UNIVERSITY
COMPUTER ENGINEERING

ORGAN ESTIMATION FROM COMPUTERIZED TOMOGRAPHY USING DEEP LEARNING

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CONTENTS

1. INTRODUCTION

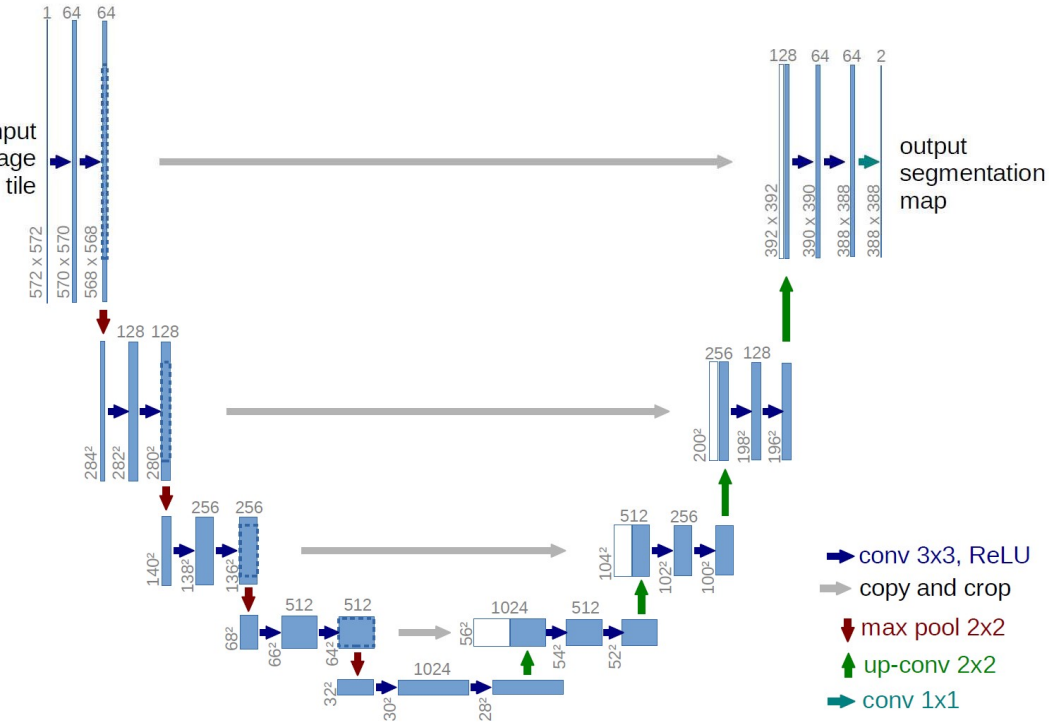
1.1. Problem Definition

- Selection of the area to be screened larger than the target area in most abdominal examinations of computed tomography is a major obstacle for doctors to make accurate and rapid progress in the clinical diagnosis and treatment of patients. Segmentation of the organ to be examined from the whole computed tomography image makes a great contribution to the effective examination of these large-scale abdominal images.

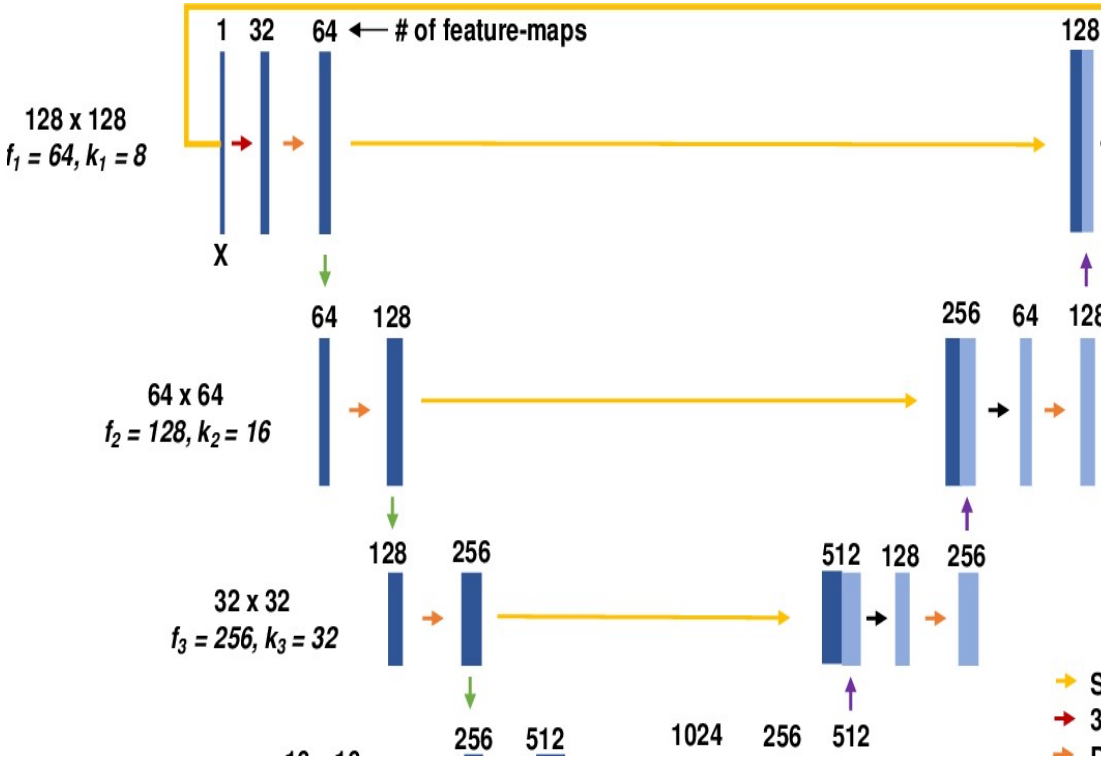
• 1.2. Aim of the Project

- The aim of this study is to provide an easier, faster and more efficient performance with automatic detection of liver in CT images for preoperative examinations, patient follow-up, organ transplantation, cancer scans.
- In addition, it is planned to integrate with LiverVision to visualize the results obtained in three dimensions. Thus, it is aimed to minimize the use of manual liver selection mechanism in the software.

2. LITERATURE



From left to right: Upsampling and Downsampling (U-Net)



Dense U-Net

3. MATERIAL and METHOD

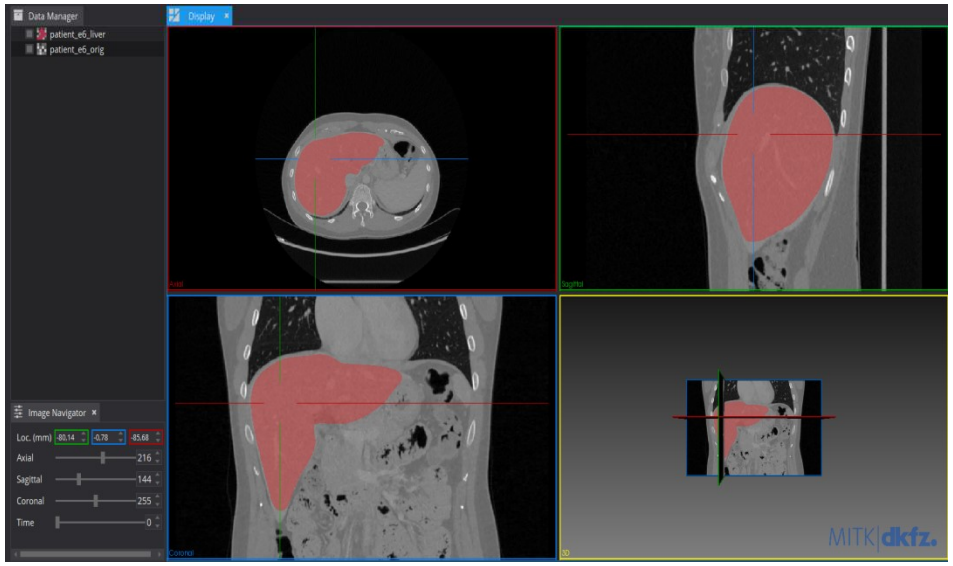
3.1. Material

- **Tensorflow:** A Python-based framework for machine learning to develop and create artificial neural networks.
- **Keras:** A Tensoflow-based library that has an extensive network of documentation on deep learning and is highly compatible with Python.
- **MatLab:** A library which is frequently used in deep learning, to draw graphics.

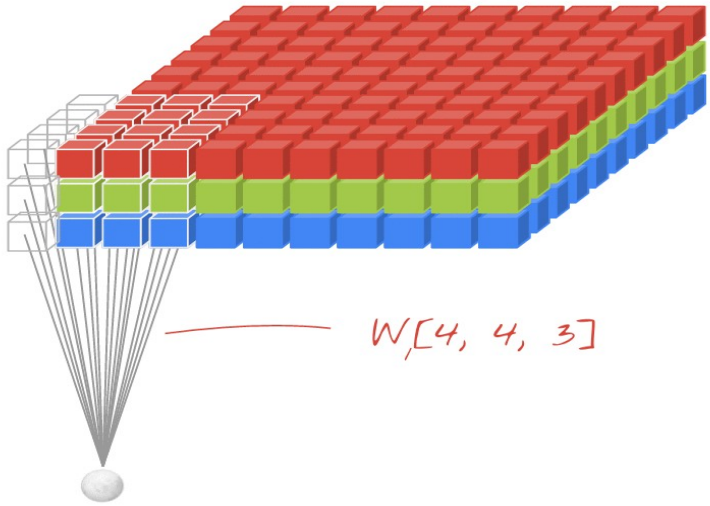
3. MATERIAL and METHOD

3.2. Method

- Preparing the Dataset



- Training of the Model



4. EXPERIMENTS

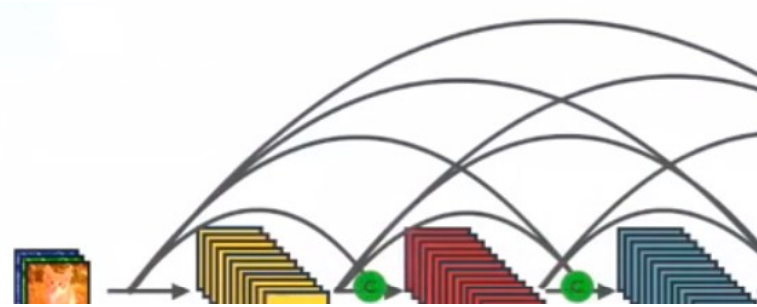
- **U-Net:** Two “mirrored” sided architecture where the image being processed is cropped after each convolution ensuring valid classification. It consists of two paths:

Contracting path
Layers: Two 3×3 convolutions + rectified linear units.
Operation on Each Layer: 2×2 max pooling which doubles the number of feature channels.
Convolution Process: Start with 64 feature channels and continue until 1024.
Output: To the expansive path.

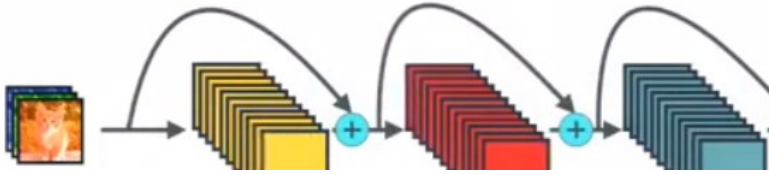
Expansive path
The last pooled output is not fed to a fully connected layer.
Layers: 2×2 “up-convolution” that halves the feature channels and increases the size of the map to meet the output size.
Operation on Each Layer: Concatenating with its pair from the contracting path, to reinclude localization information.
Convolution Process: Two 3×3 convolutions each followed by a rectified linear unit.
Output: 1x1 final layer with Sigmoid.

4. EXPERIMENTS

- **Dense U-Net:** Each layer obtains additional inputs from all preceding layers and passes on its own feature-maps. Concatenation is used. Each layer is receiving a “collective knowledge” from all preceding layers.



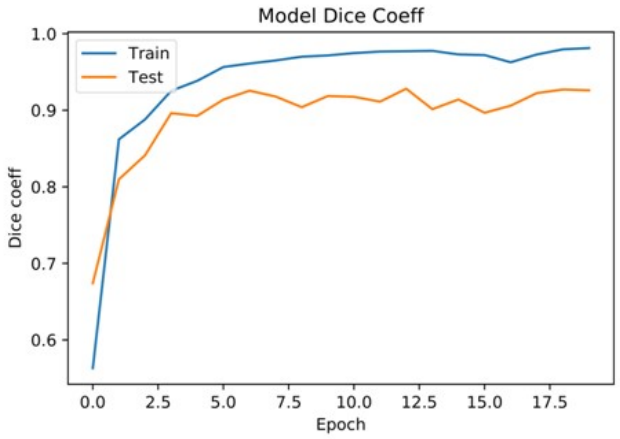
- **ResNet:** An architecture which was designed to enable hundreds or thousands of convolutional layers. It can add a large number of layers with strong performance. However, it also takes a long time to train and execute - from hours to several weeks in extreme cases.



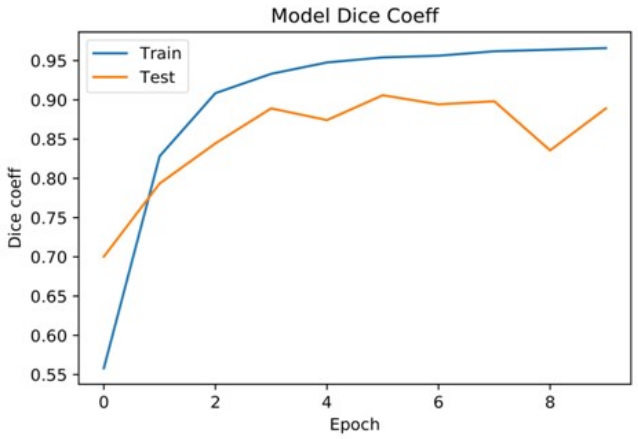
4. EXPERIMENTS

Validation Dice Score

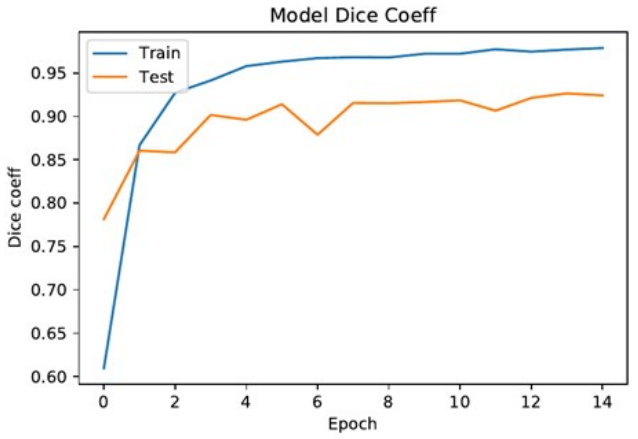
U-Net: 0.9260542393



Dense U-Net: 0. 889075458

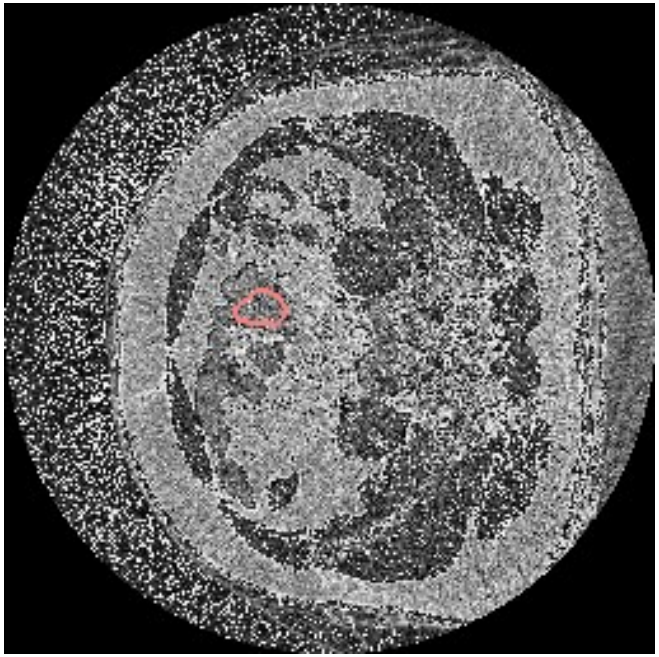


ResNet: 0.9241874814



5. CONCLUSION

- According to the results of our studies, we determined the classical U-Net as the fastest and most effective architecture in this period.



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THANK YOU

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