Liver cancer segmentation

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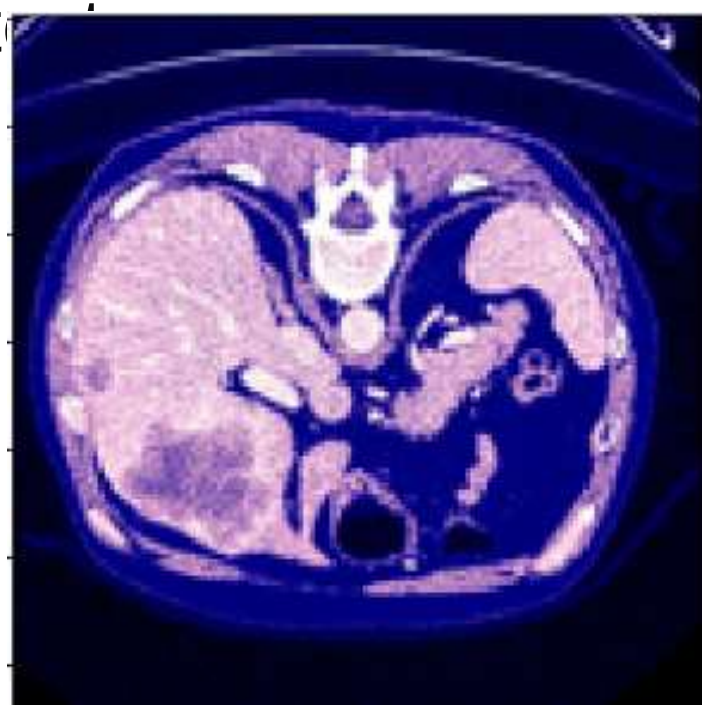
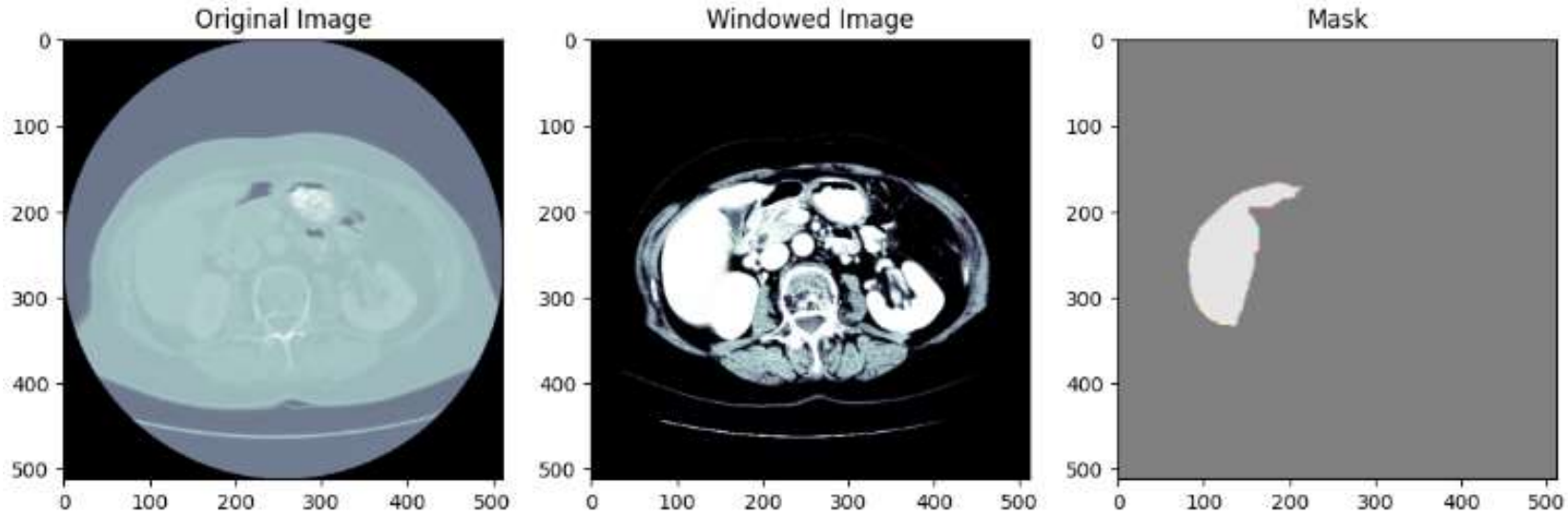
Introduction

- Liver cancer is the 5th most common cancer in men and the 9th in women
- Complex shape of tumor makes it hard to det
- Solution: neural networks
- Tensorflow, Fastai



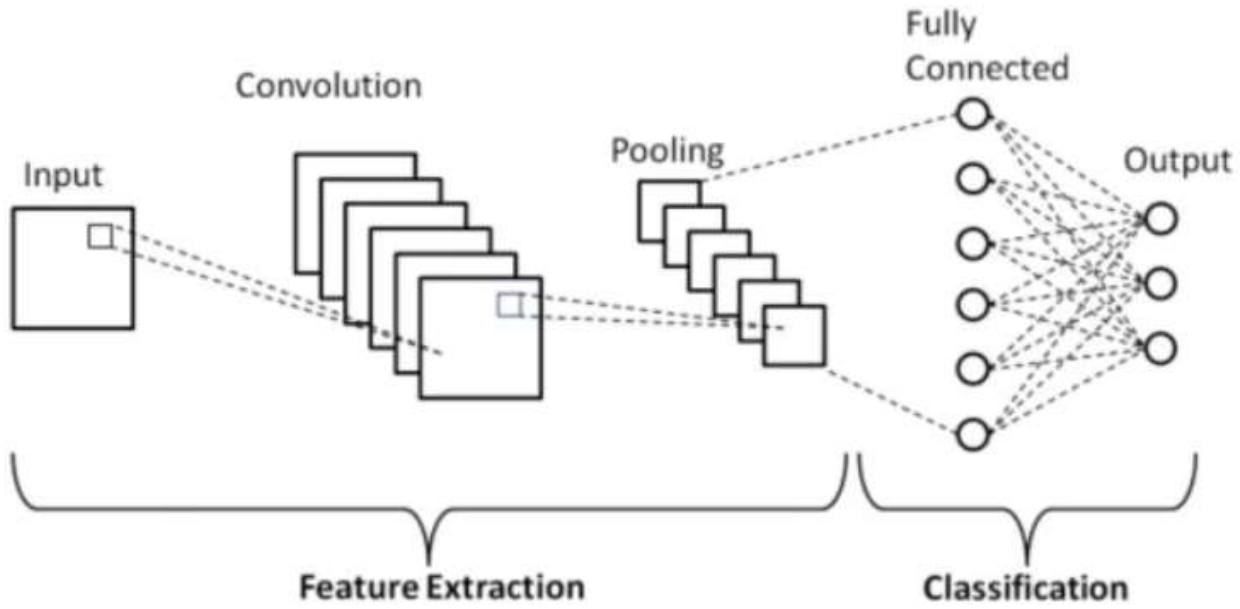
Dataset



- 131 CT scans
- Library: ‘nibabel’
- Multiple layers, each layer is 512 x 512
- Each layer has its coresponding mask
- Hounsfield scale
- Windowing
- Train set: over 17000 images

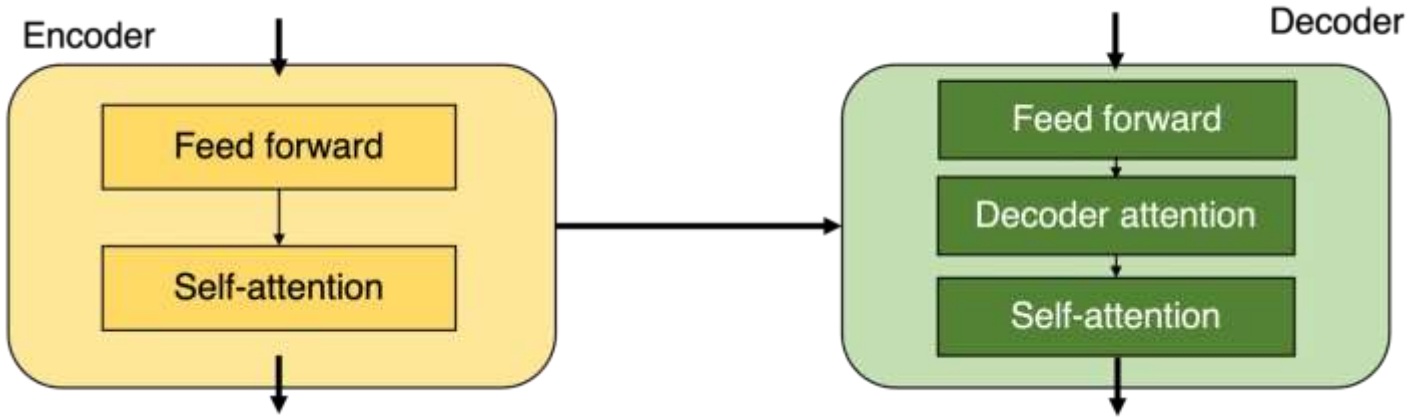
Convolution neural network

- Main focus is analysis of visual data
- Consists of :
  - Convolution layer
  - Activation layer
  - Pooling
  - Dense layer

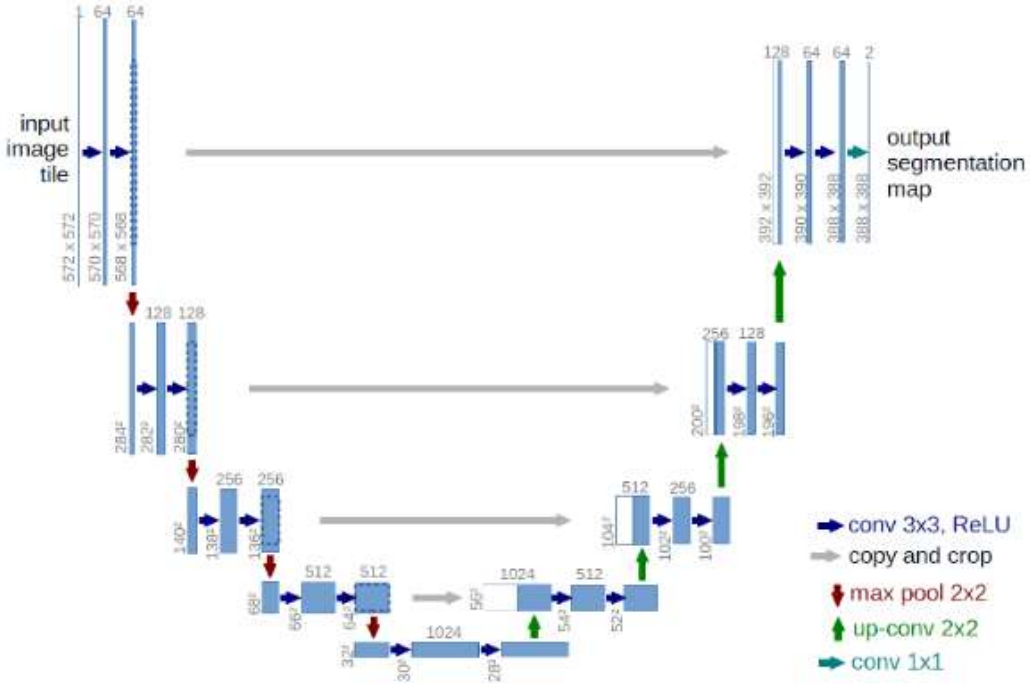


Transformer

- Architecture of deep learning
- Efficient in recognition of complex links in data
- Consists of encoder and decoder
- Encoder:
  - Self-atention
  - Feed-forward
  - Positional coding



UNet



- Most used model in medicine
- Encoder – extract features

  Conv2D -> Normalization -> ReLU -> Co

  Normalization -> ReLu -> MaxPooling
- Decoder

  Upsampling -> Concatenate -> Conv2D -> Normalization ->

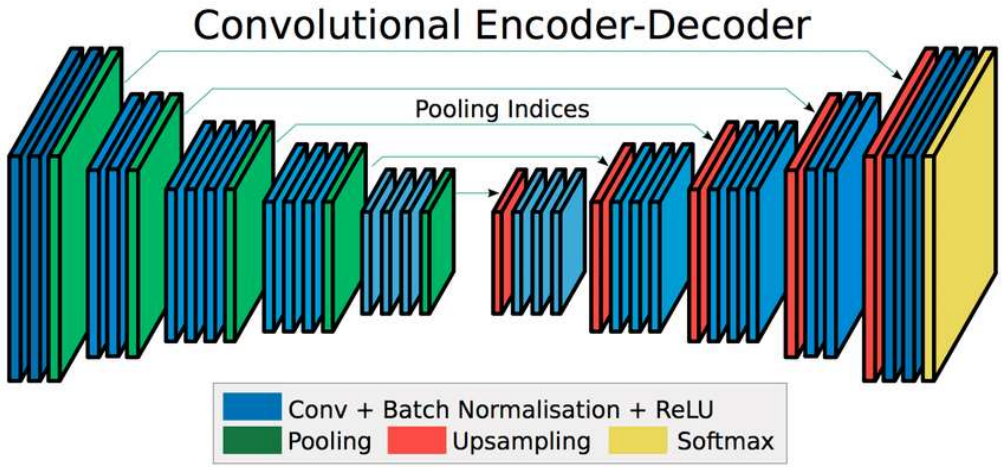
  ReLU -> Conv2D -> Normalization -> ReLu
- Skip connections
- ReLU activation

SegNet

- Indexing maximum values while max-pooling
- Encoder

  `Conv2D -> Normalization -> ReLU -> MaxPooling`
- Decoder

  `Upsampling -> Conv2D -> Normalization -> ReLU`



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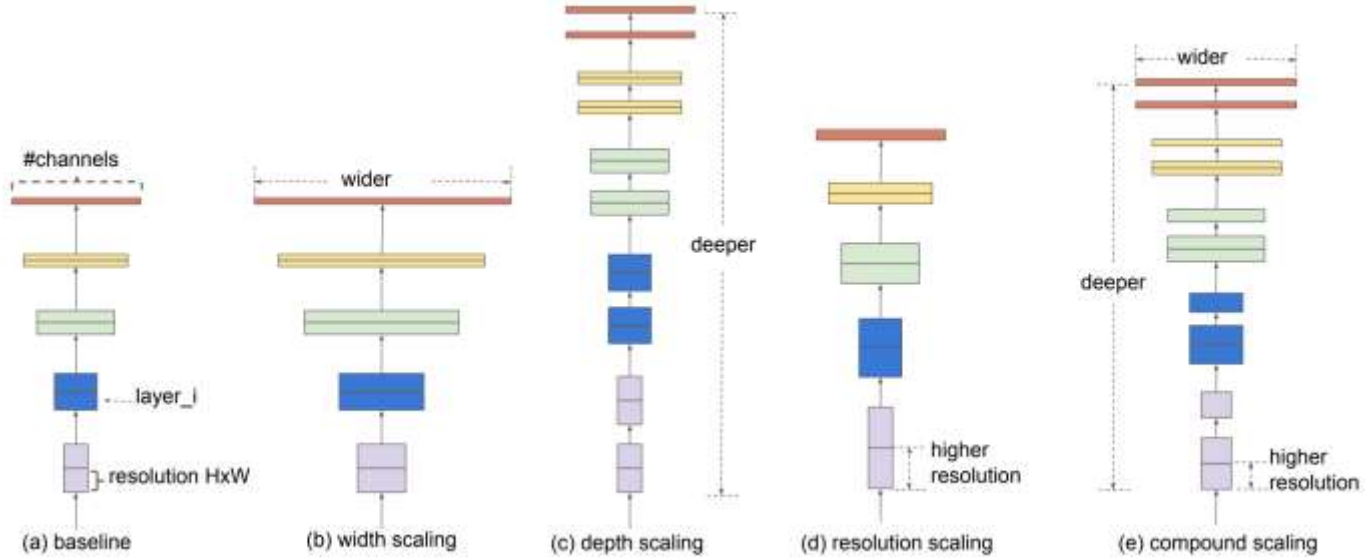
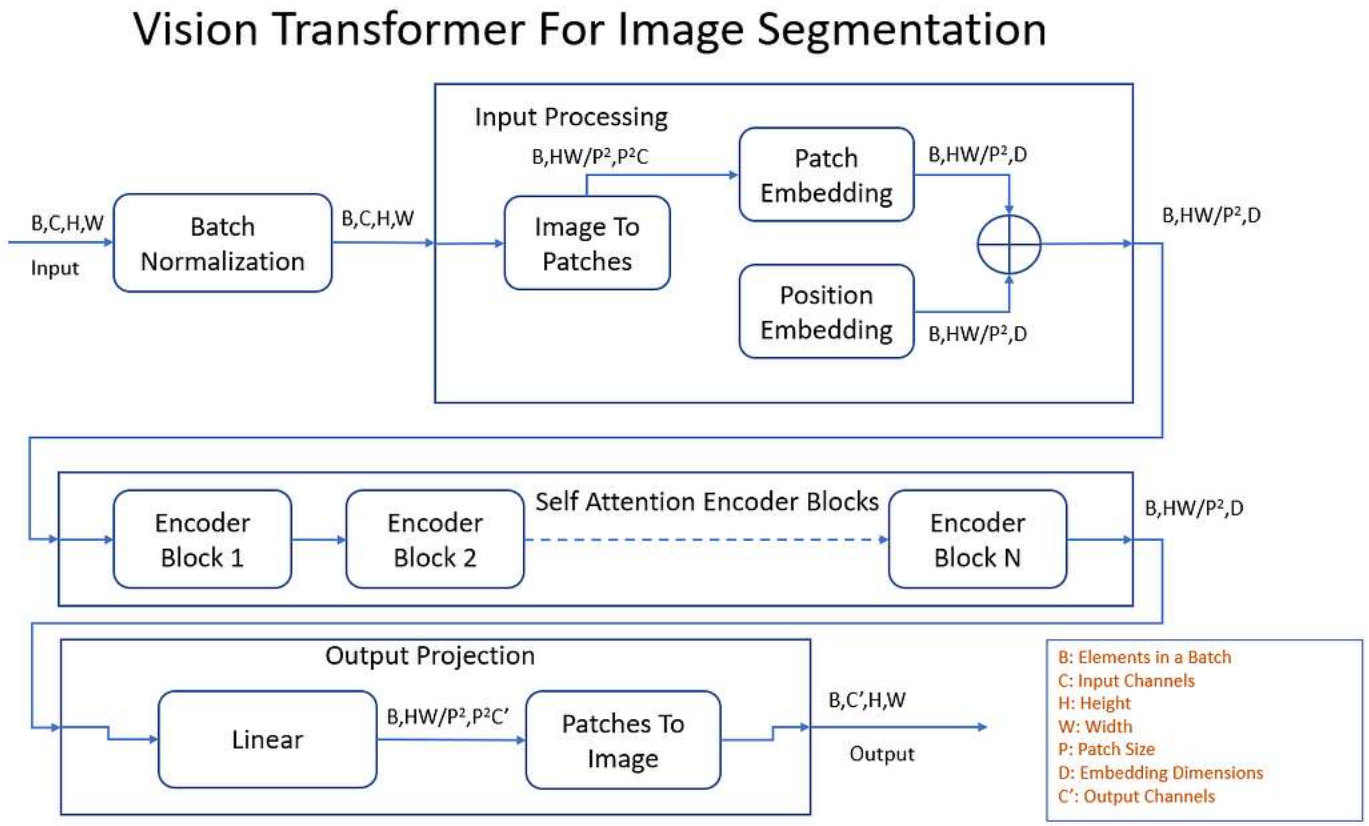


- B0 – B7
- Compound scaling
- Trained on imagenet dataset
- Feature extractor
- Adapted for segmentation with decoder

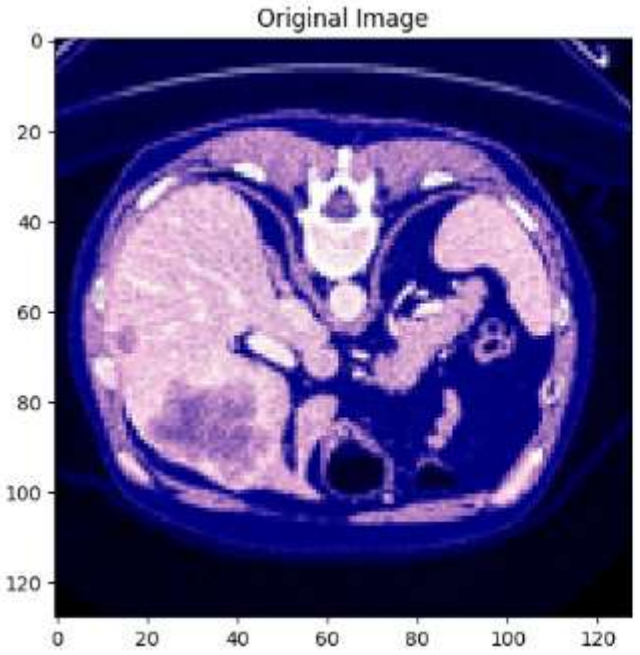
Transformers

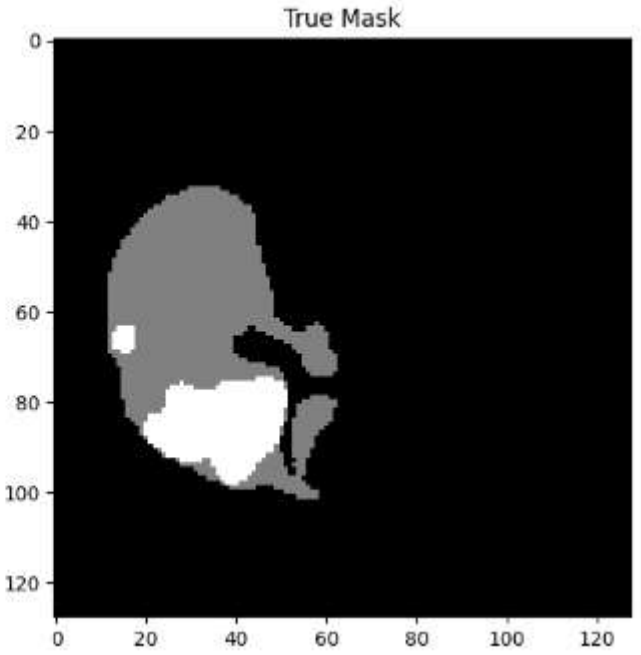
- Batch normalization
- Image to patches
- Embeddings
- Transformer encoder
- FC layer
- Patch to image

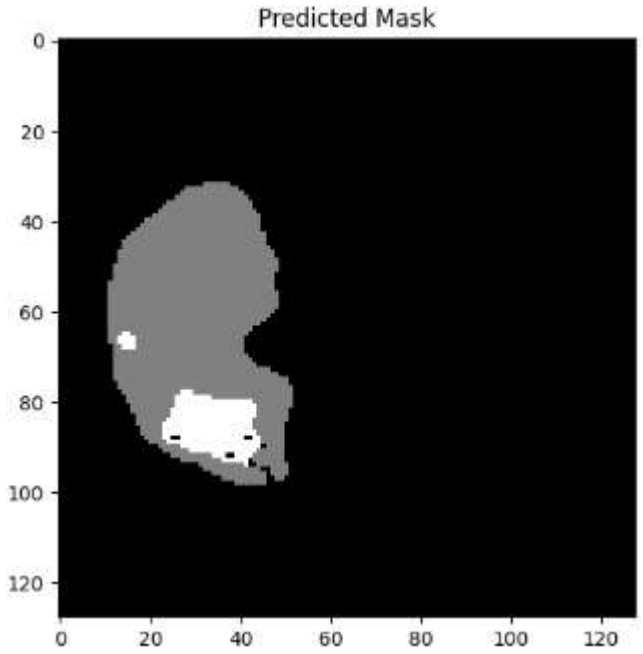


Results: UNet

- Hyperparamethers:
  - Learning rate: 0.00
  - Batch size: 16
  - Epochs: 3
  - Class weight: bg – 1, liver –
- Adam, categorical corssentro
- Results:
  - Dice score: 0.9846
  - Precission: 0.9953

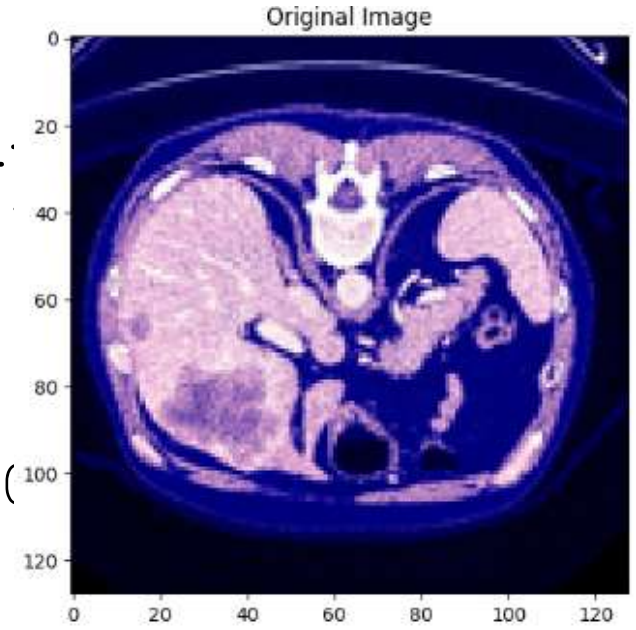


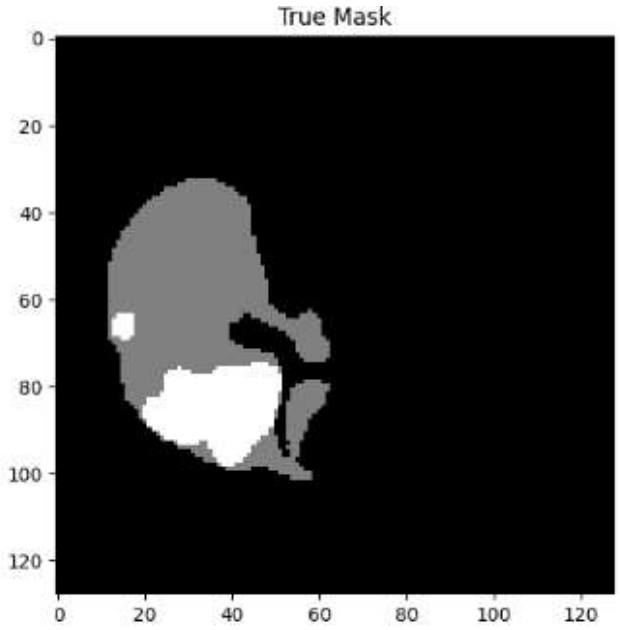


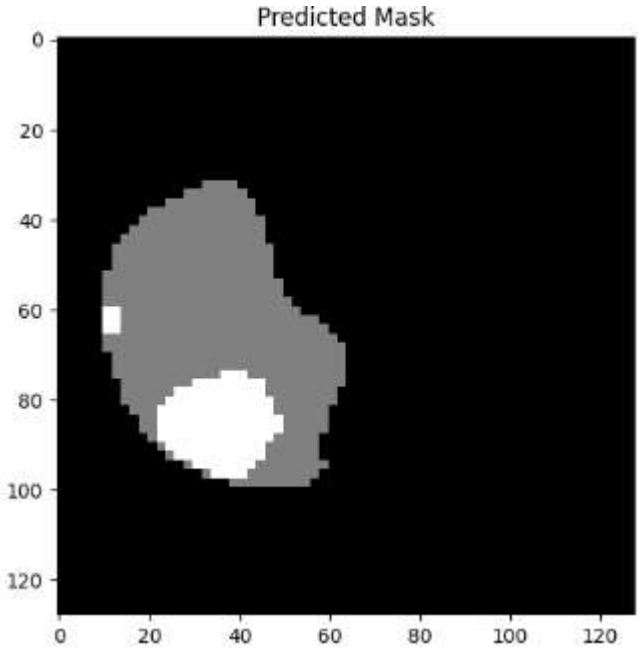


Results: Seg

- Hyperparamethers:
  - Learning rate: 0.0(
  - Batch size: 16
  - Epochs: 5
  - Class weight: bg – 1, liver – 5
- Adam, categorical corssentrop
- Results:
  - Dice score: 0.9899
  - Precission: 0.9908

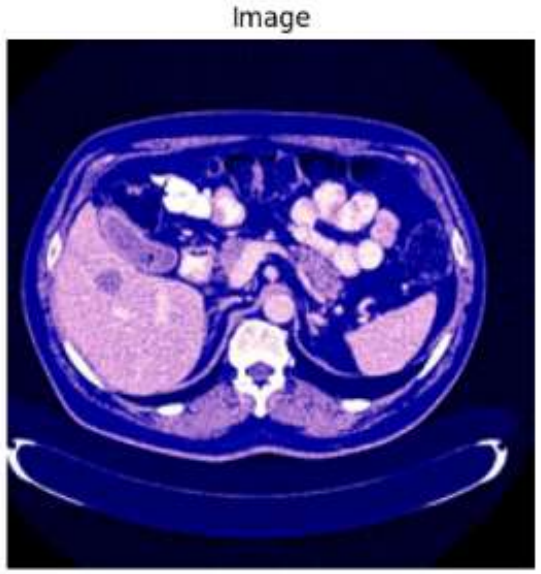


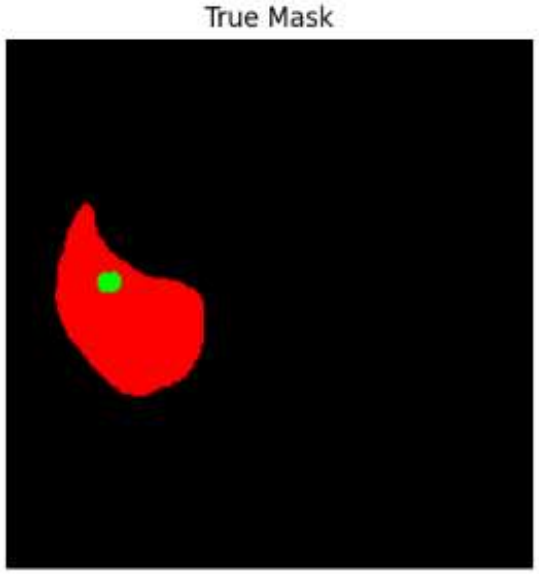


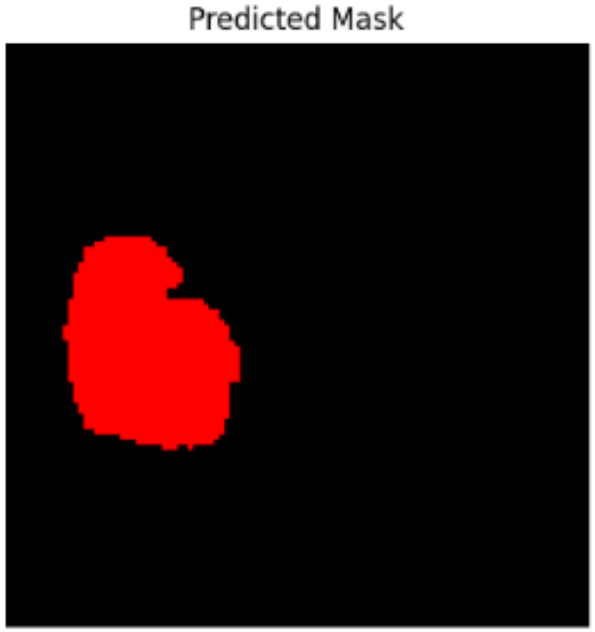


Results: Efficie

- Hyperparamethers:
  - Learning rate: 0.001
  - Batch size: 64
  - Epochs: 20
- Adam, categorical corssentropy
- Results:
  - Dice score: 0.944
  - Accuracy: 0.9502

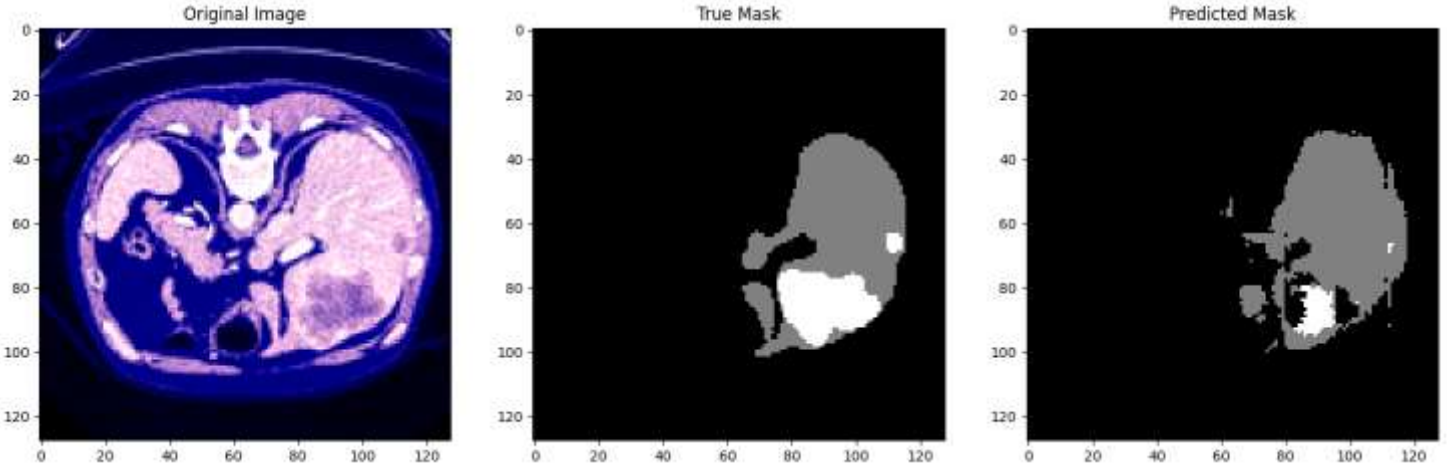






Results: Transformer

- Hyperparamethers:
  - Learning rate: 0.00(
  - Batch size: 64
  - Epochs: 10
- Adam
- categorical corssen
- Results:
  - Dice score: 0.9921
  - Accuracy: 0.9948



Conclusion

- Convolution neural networks are great solution for liver cancer segmentation
- Accuracy is not yet high enough for clinical use

Literature

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