Medico automatic polyp segmentation challenge*

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* https://multimediaeval.github.io/editions/2020/

Motivation

- Colorectal cancer (CRC) is the **third most prevailing** strain in terms of cancer incidence and **second in terms of mortality** globally.
- Colonoscopy is mainly used to detect abnormalities such as cancer.
- **~ 20%** of polyps are **missed** during colonoscopy

An automated computer-aided diagnosis (CAD) system could be one of the potential solutions for the overlooked polyps.

Data: Kvasir-SEG Dataset

- 1000 training pairs
- Pre-defined split: 880/120
- Sizes: from 332x487 to 1920x1072 pixels

- Separate testing set

Note, we only focus on the **segmentation** problem.

Image   Ground Truth   Bounding Box
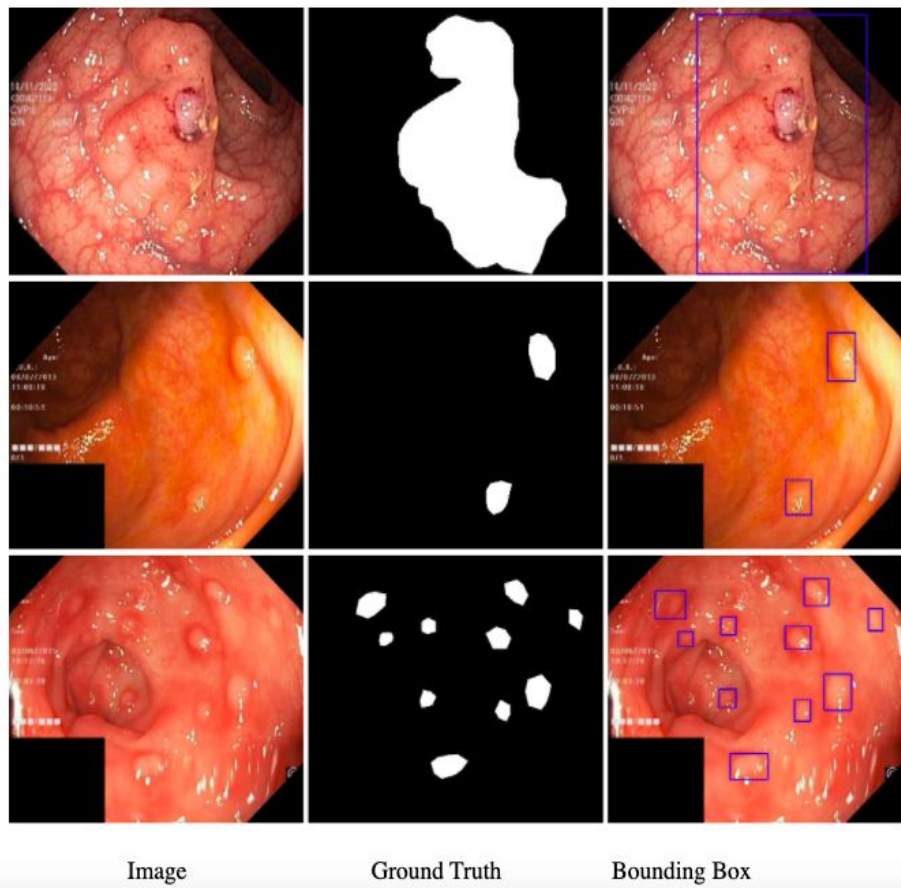
Typical Metrics for Segmentation Tasks

- Binary Cross Entropy
- Intersection over Union (IoU)
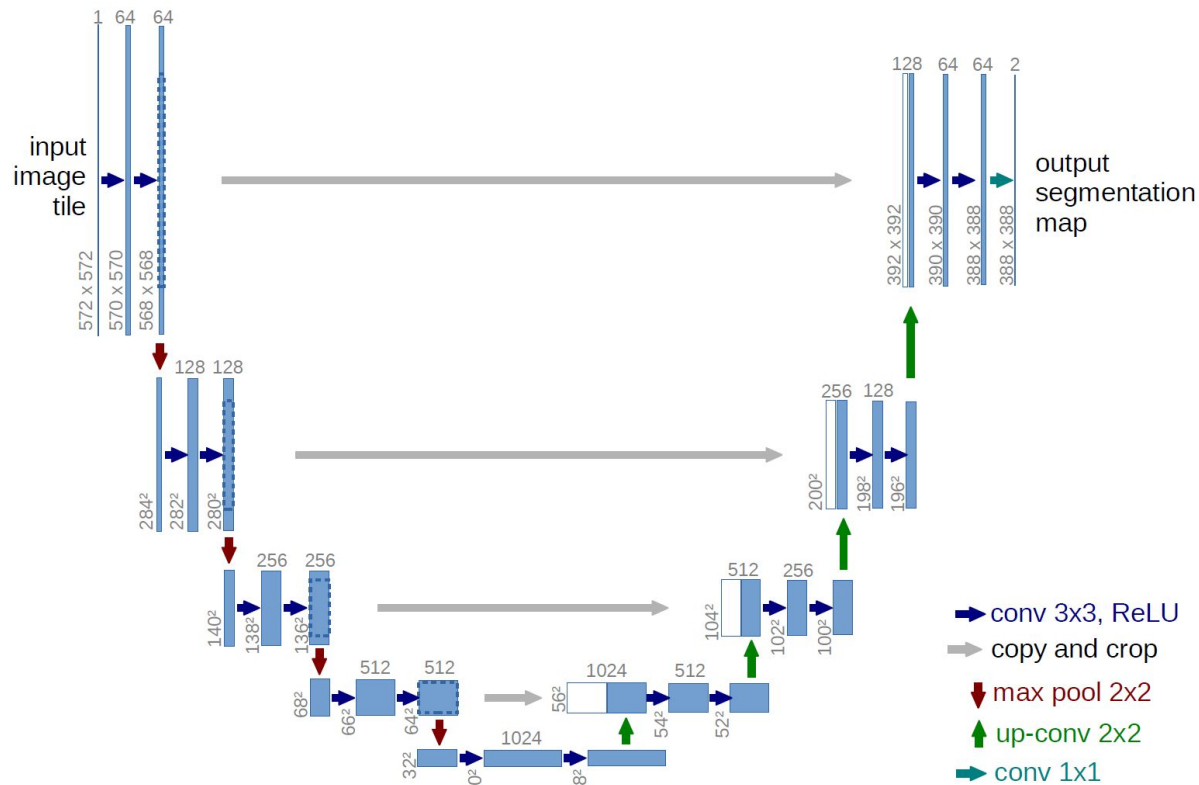- Dice Coefficient

Challenge Focus

- **Intersection over Union (IoU)**
- Dice Coefficient (to resolve ties)

Methods 1: Preprocessing

- Resize to 256 x 256 pixels
- Normalize Images. Use means and std-s pre-computed from training set.
- Binarize masks

Methods 2: Architecture

Methods 3: Losses

- Intersection over Union (IoU)
- Binary Cross Entropy (BCE)
- Combined

Problems

- IoU requires binary mask as an output of the model
- Binarizing IoU reduces gradient-flow
- Using non-binarized IoU is hard to interpret

Methods 3: Losses - Decision

Training:

- Non-binarized Intersection over Union (IoU)
- Binary Cross Entropy (BCE)
- Combined

Validation:

- Binarized Intersection over Union (IoU)

Methods 4: Epochs, Optimisation

- 40 epochs, best model chosen according to the validation IoU

- Optimiser: Adam
  - Learning rate: 1e-4
  - Weight decay: 1e-8

Results, Validation set

Loss	Best Epoch	Train IoU	Val IoU
BCE	34	0.932	**0.689**
IoU	37	0.893	0.685
Combined	34	0.908	0.665

- BCE: Binary Cross Entropy
- IoU: Intersection over Union
- Combined: BCE and IoU together

Note, reported IoU scores were computed for resized masks.

Possible Improvements

- Use Augmentation and Dropout for regularisation
- Try different variations of the U-Net:
    - Trainable downsampling layers, e.g. convolutions with stride > 1
    - Sophisticated "Information" blocks, e.g. Inception blocks, Dilated convolutions
    - ResNet blocks after Concationations
- Try different optimisers

Note, mean IoU score for the test set will be provided by the challenge organisers.