1.The loss function is binary cross entropy loss. The connection is that it can provide more accurate predictions on the boundaries by skipping connections. (U-Net)

2. Epistemic Uncertainty is a kind of model uncertainty. It describes confidence in the prediction. When missing the training data, it will increase. It can be reduced by adding more data.
   Aleatoric Uncertainty is a kind of data uncertainty. It describes confidence in the input data. When the inputted data is noisy, it will increase. It cannot be reduced by adding more data.

3.
Sampling in the Dropout model allows for epistemic uncertainty estimation by the following formulas:

$$E(\hat{Y}|X) = \frac{1}{T}\sum_{t=1}^{T} f(X|W_t)$$

$$Var(\hat{Y}|X) = \frac{1}{T}\sum_{t=1}^{T} f(X)^2 - E(\hat{Y}|X)^2$$

In the model, we randomly drop out some individual weights across the kernels according to Bernoulli distribution and do this a bunch of times. Then, we will be able to approximate a probability distribution and consider the expectation or the mean of the prediction, as well as the variance. Finally, by the variance we can derive an uncertainty estimate.

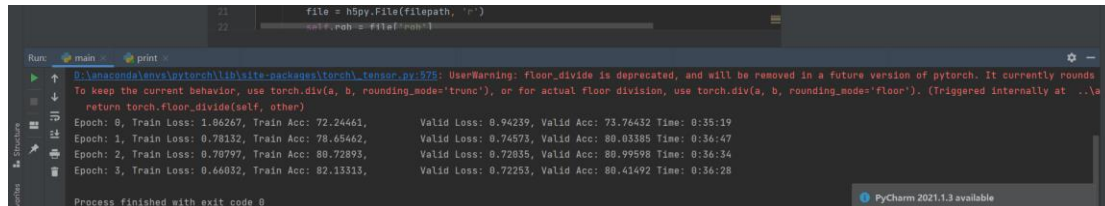# Software Lab

2.The schematic of our model:
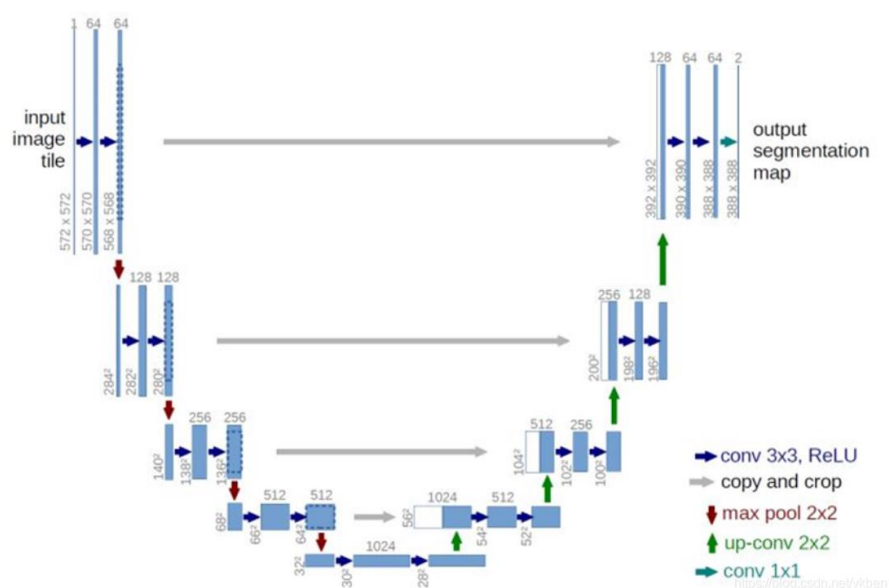
5.

c. After checking the literature, we found Unet++, an improved model of Unet model. Unet++ draws on the dense connection of DenceNet, and the main improvement to Unet is skip connection. The idea of deep supervision is also introduced. The loss function of the network is the average of the loss of the segmentation map obtained by different layers, and the loss function of each layer is the sum of DICE LOSS and Binary cross-entropy LOSS.

At the same time, we also found the combination of U-net and ResNet, the improved U-NET is divided into two parts: shrinking network and expanding network.

The shrinking network is similar to the shrinking network in U-NET. The difference is that the output results of each layer are first normalized, and then activated by the activation function. Each downsampling contains two 3x3 convolutional layers, a 1x1 "shortcut" and a 2x2 pooling layer.

d.