# Semantic Segmentation on BCSS

B092040016 陳昱逢

Assignment 7

## 1 U-Net architecture

Figure 1 呈現了 U-Net [1] 的架構圖，其部分想法類似於 ResNet 的殘差概念，更好地運用先前層的特徵，以達到好的分割效果。程式實作部分則是分每個節點都經過雙層的 convoluttion，再經由下採樣 (downsampling) 或是上採樣 (upsampling)，其中上採樣經過一個類似於 fully convolution network (FCN) 中的反卷積 (deconvolution) 的概念，最後最淺層的 decoder 再經由最後一個卷積層輸出 mask。

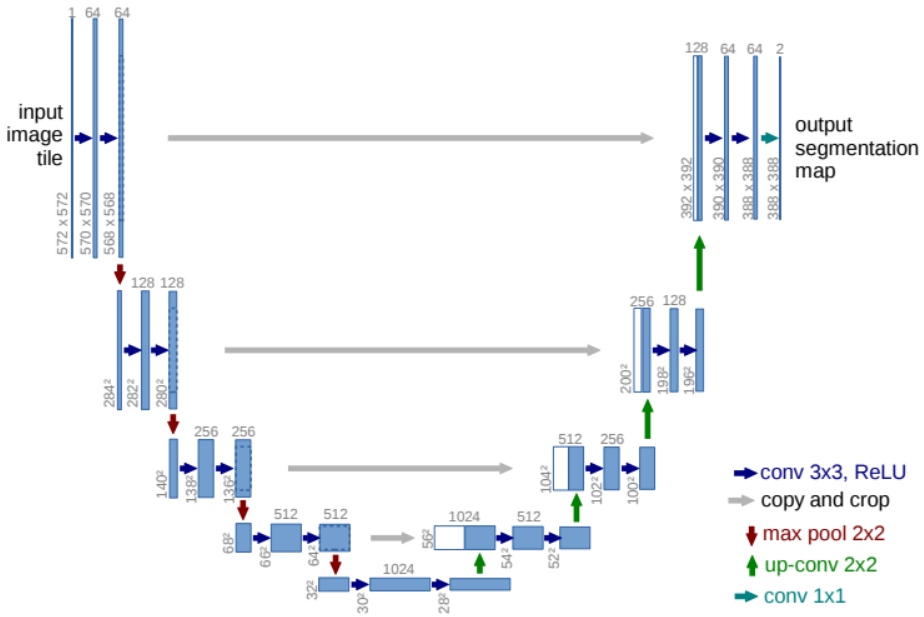


Figure 1: U-Net architecture [1]

## 2 增加模型的表現

為了增加模型的表現度，我採取了 U-Net++ [2] 的類似想法，主要分成一個 donwsample 的 stream 以及很多 upsample 的 stream，考量實作方便以及運算資源，我只有實作四層的 U-Net++，以及簡化了一些殘差 (Residual) 的步驟，以確保我模型的通道累計是正確的。相信此模型再結合了許多個

upsample 的 stream 後，模型的表現度可以再次被提高。Figure 2 呈現了我的模型，想法來自於 U-Net++ [2] 。

```python
class UNetPlusPlus(nn.Module):
    def __init__(self, n_channels, n_classes):
        super(UNet, self).__init__()
        self.n_channels = n_channels
        self.n_classes = n_classes
        self.inc = DoubleConv(n_channels, 64)
        self.down00 = Down(64, 128)
        self.down10 = Down(128, 256)
        self.down20 = Down(256, 512)
        self.outc = OutConv(64, n_classes)
        self.up01 = Up(128, 64)
        self.up11 = Up(256, 128)
        self.up02 = Up(128, 64)
        self.up21 = Up(512, 256)
        self.up12 = Up(256, 128)
        self.up03 = Up(128, 64)
    def forward(self, x):
        x00 = self.inc(x)
        x10 = self.down00(x00)
        x01 = self.up01(x10,x00)
        x20 = self.down10(x10)
        x11 = self.up11(x20,x10)
        x02 = self.up02(x11,x01)
        x30 = self.down20(x20)
        x21 = self.up21(x30,x20)
        x12 = self.up12(x21,x11)
        x03 = self.up03(x12,x02)
        logits = self.outc(x03)
        return logits
```

Figure 2: U-Net++ code

# References


[1] O. Ronneberger, P. Fischer, and T. Brox, "U-net: Convolutional networks for biomedical image segmentation," in *Medical Image Computing and Computer-Assisted Intervention–MICCAI 2015: 18th International Conference, Munich, Germany, October 5-9, 2015, Proceedings, Part III 18*. Springer, 2015, pp. 234–241.

[2] Z. Zhou, M. M. Rahman Siddiquee, N. Tajbakhsh, and J. Liang, "Unet++: A nested u-net architecture for medical image segmentation," in *Deep Learning in Medical Image Analysis and Multimodal Learning for Clinical Decision Support: 4th International Workshop, DLMIA 2018, and 8th International Workshop, ML-CDS 2018, Held in Conjunction with MICCAI 2018, Granada, Spain, September 20, 2018, Proceedings 4*. Springer, 2018, pp. 3–11.