

HW #9

1. **NN Activation Functions (40%):** The Logistic function $L(\Sigma) = \frac{1}{1+e^{-\Sigma}}$ ranges from 0 to 1.

The Hyperbolic tangent function $\tanh(\Sigma) = \frac{\sinh(\Sigma)}{\cosh(\Sigma)}$ ranges from -1 to 1. Either function may be used as the activation function for a Neural Network. Derive an expression for $\tanh(\Sigma)$ in terms of $L(\Sigma)$.

2. **IoU (30%):** Intersection over Union (IoU) of two regions (or sets) A and B is defined as

$\frac{|A \cap B|}{|A \cup B|}$. It is a commonly-used performance measure for NNs. Show that $\text{IoU}(A, B) = 1 -$

$$\frac{|A \text{ xor } B|}{|A \cup B|}.$$

3. **CNNs (30%):** In LeNet-5

- How many connections are in layer C3? Don't just give a number, justify your answer.
- How many trainable parameters are in layer C3? Justify your answer.