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DIP Assignment 4

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Find W

$$\sum_k \sum_l |W(k,l)G(k,l) - F(k,l)|^2 + \gamma \sum_k \sum_l |L(k,l)W(k,l) - N(k,l)|^2$$

$$\frac{\partial}{\partial W} \left[\sum_k \sum_l |W(k,l)H(k,l)F(k,l) + W(k,l)N(k,l) - F(k,l)|^2 + \gamma \sum_k \sum_l |L(k,l)W(k,l)H(k,l)F(k,l) + L(k,l)W(k,l)N(k,l) - F(k,l)|^2 \right]$$

$$= \frac{\partial}{\partial W(k,l)} \left[F(k,l)(W(k,l)(H(k,l)-1) + W(k,l)N(k,l)) \right]^2$$

$$= \frac{\partial}{\partial W(k,l)}$$

$$\frac{\partial}{\partial W(k,l)}$$

$$= \frac{\partial}{\partial W(k,l)} (|F|^2 |WH-1|^2 + |N|^2 |W|^2) + \gamma \frac{\partial}{\partial W(k,l)} (|L|^2 |W|^2 |H|^2 + |L|^2 |W|^2 |N|^2)$$

$$2|F|^2 (WH-1)^* H + 2|N|^2 W^* + \gamma (2|L|^2 |H|^2 W^* + 2|L|^2 |N|^2 W^*) = 0$$

$$2|F|^2 (WH-1)^* H$$

$$2|F|^2 (W^* H^* - 1) H + 2|N|^2 W^* + \gamma (\dots) = 0$$

$$\cancel{2|F|^2 W^* |H|^2} \sim \cancel{2|F|^2 H} + \cancel{2|N|^2 W^*} + \gamma (\dots) = \cancel{2|F|^2 H}$$

$$W^* = \frac{|F|^2 H}{|F|^2 |H|^2 + |N|^2 + \gamma (|L|^2 |H|^2 + |L|^2 |N|^2)}$$

$$|F|^2 |H|^2 + |N|^2 + \gamma (|L|^2 |H|^2 + |L|^2 |N|^2)$$

$$H$$

$$\left(\frac{|N|^2}{|F|^2} = k \right)$$

$$\frac{|H|^2 + |N|^2}{|F|^2} + \gamma \left(\frac{|L|^2 |H|^2}{|F|^2} + \frac{|L|^2 |N|^2}{|F|^2} \right)$$

$$W^* = \frac{H}{|H|^2 + k + \gamma (|L|^2 + |L|^2 k)}$$

$$|H|^2 + k + \gamma (|L|^2 + |L|^2 k)$$

$$\Rightarrow \frac{H^*}{(k|H|^2 + k)(1 + \gamma |L|^2)} = W$$