Competitive Learning Classifier for LFW

Authors: James Mnatzaganian & Qutaiba Saleh

Date: 05/07/15

Two competitive networks are used for the purpose of gender recognition. The structure of the network is shown in ***Figure 1***. A software model of the network was successfully tested to recognize genders with accuracy of up to 70%. More information about the software model are available in the previous write-up.

As can be seen in ***Figure 1*** the network consists of two identical competitive networks. The hardware model makes use of this fact to reduce the size of the design of almost 50%. One hardware network model was used for both of the male and female networks. This was achieved by saving the weight values for the networks in two separate registers.

Figure 2 shows the input and output signal of the hardware model. The Mode signal is used to select one of four different modes: Idle, Weight Initialization, Training, and Testing. During the Idle mode, the system is simply doing nothing except waiting for incoming inputs. The Initialization mode is used to generate the initial weights values for both of the networks. I LFSR is used to generate these weights. As seen in ***Figure 2*** the seed of the LFSR can be changed by the user. This gives the flexibility to generate different initial weights in different runs which is important for the optimization purposes. ***Figure 3*** shows a more internal details of the system.

The hardware model is working well in three different modes: Idle, Initialization and Training. ***Figure 4*** and ***Figure 5*** show waveforms for the Initialization mode. ***Figure 4*** shows the starting of the process by changing the mode signal into '01'. The LFSR starts generating weights based on the seed received at the beginning of the process through the LFSR_init port. The weights are shifted into the male weight register. Once this register is full, the weights are fed into the female network as shown in ***Figure 5***.

Figure 6 shows waveforms of the training process. The weight update block is responsible for receiving new input vector and update the weights of the networks. The weights are fed into this block through a multiplexer that is controlled by the input label as shown in ***Figure 3***.

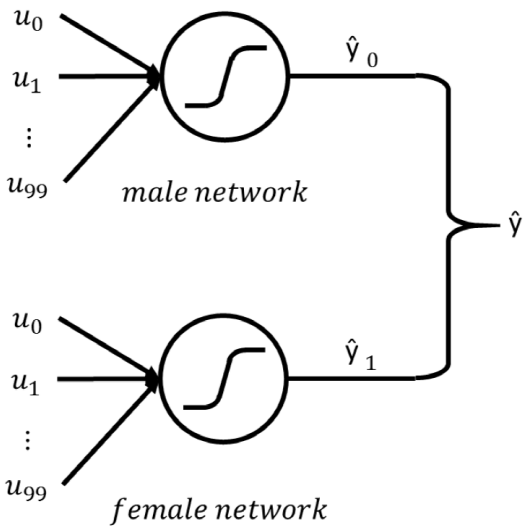

Figure 1: Competitive learning network structure.

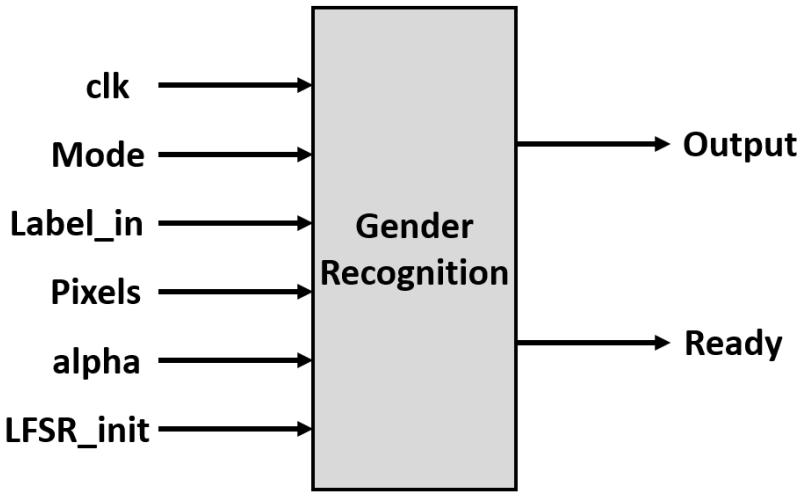

Figure 2: System inputs and outputs.

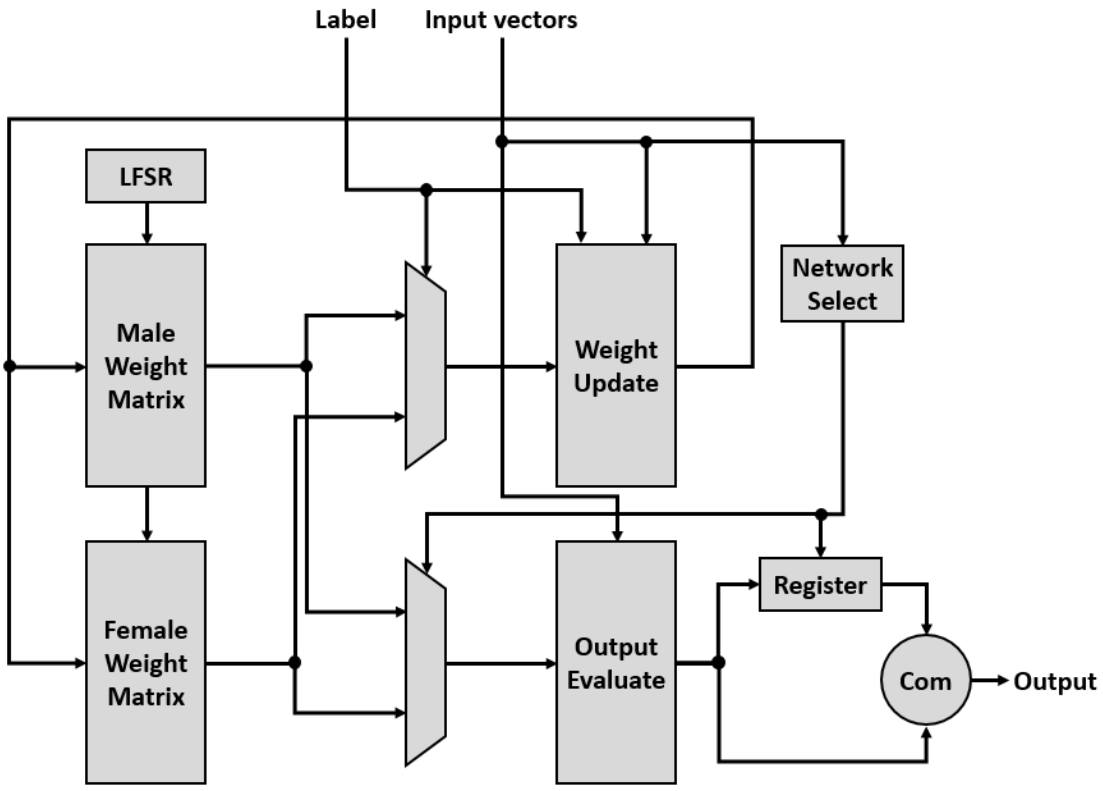

Figure 3: Simplified RTL representation of the overall system.

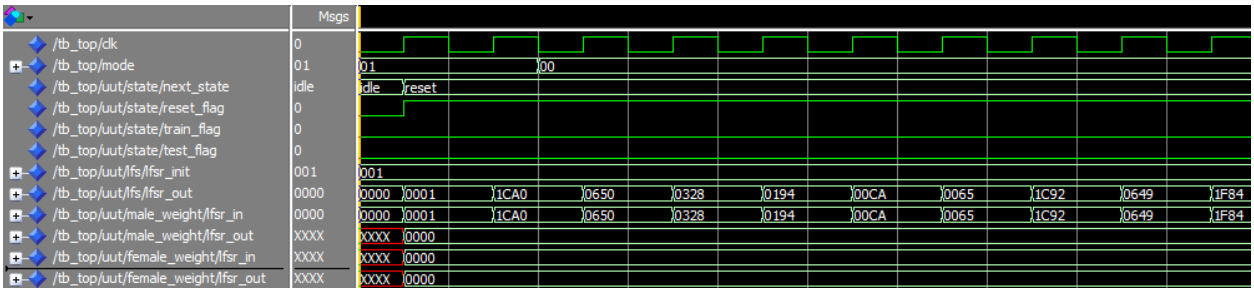

Figure 4: Start of Initialization mode. The weights are fed into the male network from the LFSR.

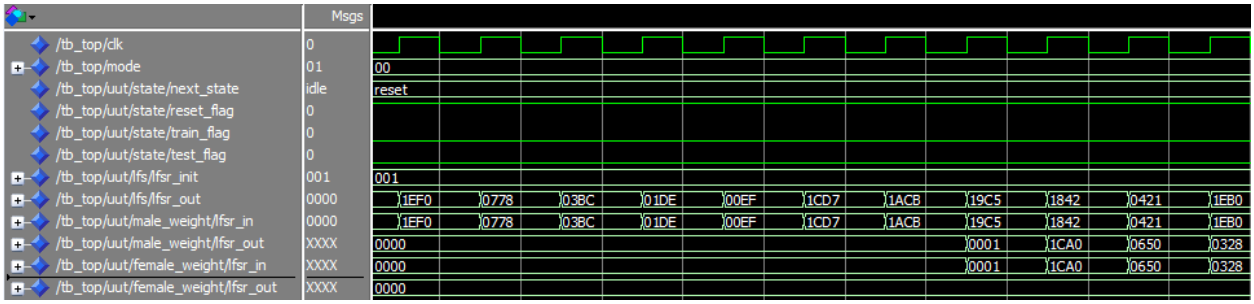

Figure 5: Middle of initialization. The weights are been shifted the female network.

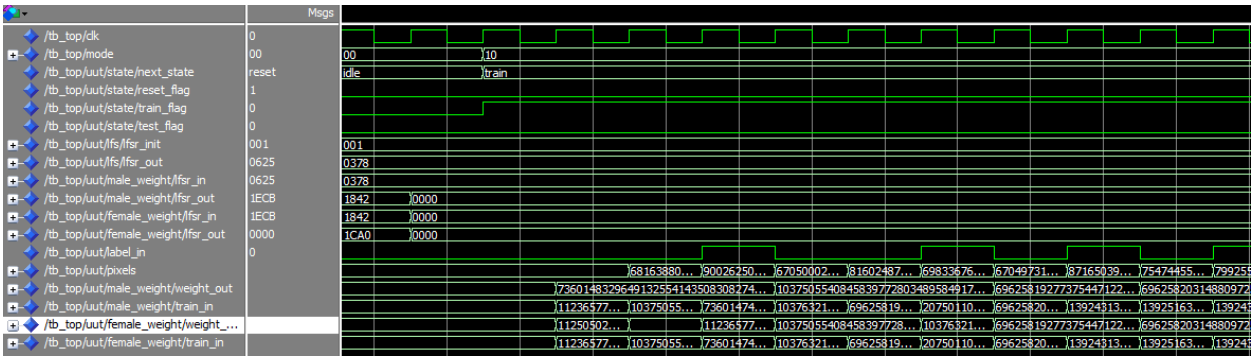

Figure 6: Training mode of operation.