Real-Time Phoneme Recognition Using a Neural Computer

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Goal of the Project

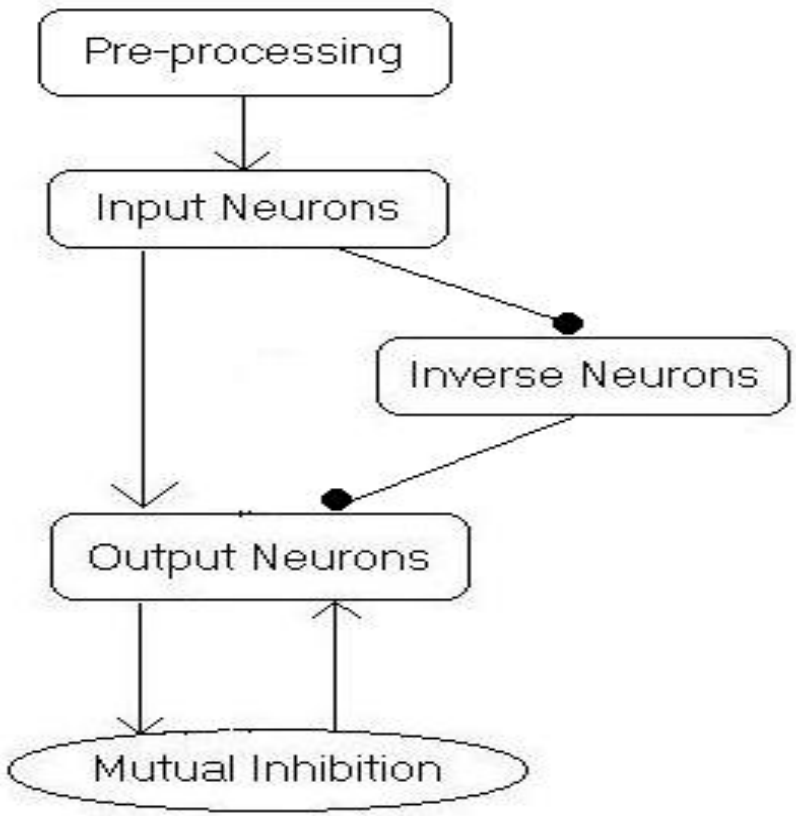
- Develop an algorithm that is to be implemented on the neural computer
- The algorithm trains the network in such a way that the neurons respond to different phonemes

What Is a Neural Network?

- An information-processing system
- Collection of simple independent elements called neurons
- Neurons are connected by synaptic weights
- Output of the neuron is the function of the inputs it has received

$$E_k = f(\Sigma E_i \sigma_i)$$

Topology Overview



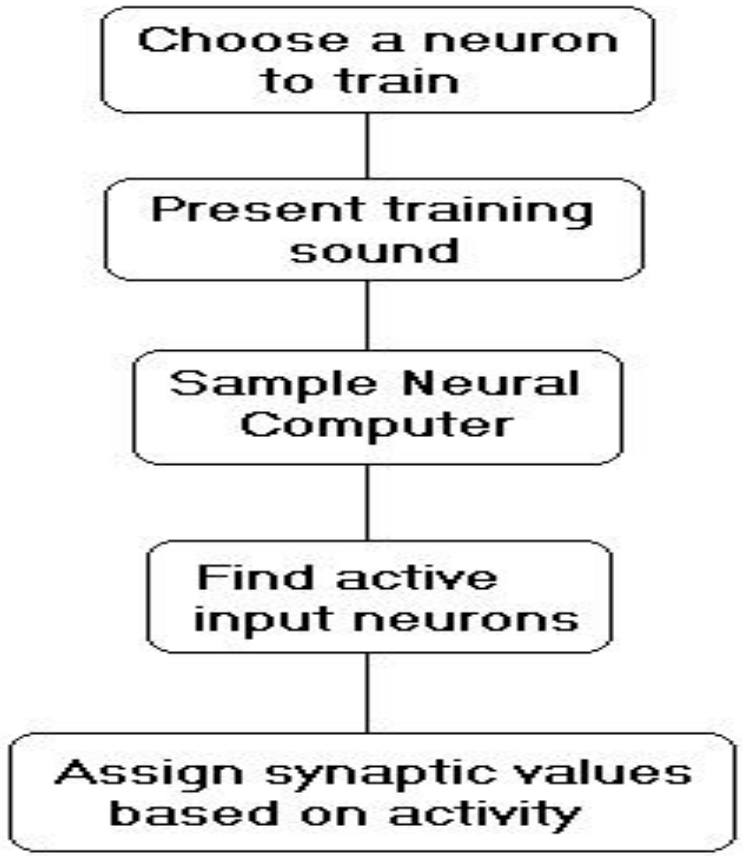
Preprocessing, Input and Inverse Neurons

- Incoming signals are broken into sixteen frequency bands in the cochlea
- Each frequency band is fed into an input neuron, which amplifies the signal
- Each inverse neuron corresponds to the inverse of the input neuron

Mutual Inhibition

- The output of each neuron is piped into every other neuron including itself
- The synaptic weight connecting a neuron to itself is positive while the rest are negative
- Used to select the output neuron that fires the strongest

Training Algorithm

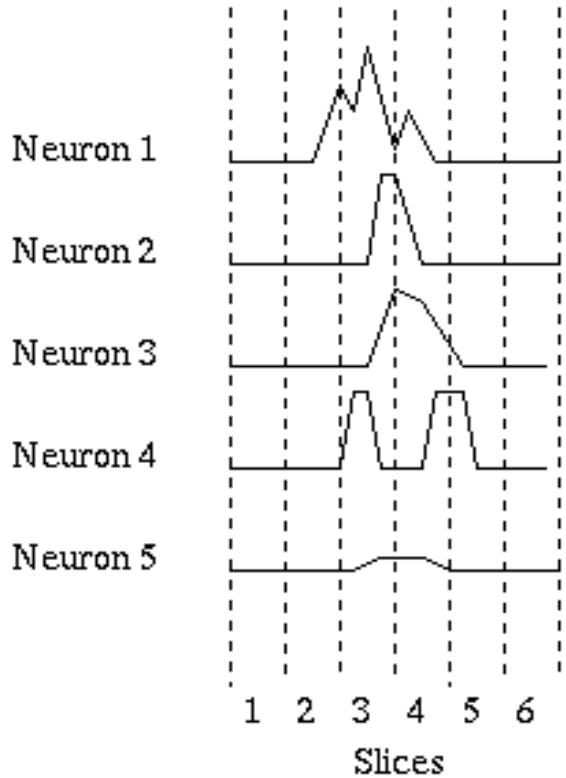


Computing the Synaptic Weights

- Maximum point method
- Average point method

Maximum Point Method

- The sampling time line is cut into several time slices
- The maximum for each neuron during each time slice is found



Maximum Point Method continued

- The maximums of each time slice is averaged to find slice with most activity
- The synaptic weights are assigned based on percentage of activity to total during maximal time slice

Average point method

- The only difference between the average point method and the maximum point method is that the average value for each neuron during each time slice is found instead of the maximum point

Results for Maximum Point Method

	/iy/	/aa/	/ow/
/iy/	80%	10%	0%
/aa/	30%	80%	30%
/ow/	0%	20%	80%

Results for Average Point Method

	/iy/	/aa/	/ow/
/iy/	90%	0%	0%
/aa/	22%	88%	22%
/ow/	0%	10%	100%

Summary

- The average point method performed slightly better than the maximum point method
- The algorithm shows much promise for real time phoneme recognition with over 90% positive responses

Discussions

- Further examination of the vowel sounds and the preprocessing stage would be useful
- It was found that, depending on the preprocessing stage, the center surround function in particular, the result could vary significantly

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