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EE 456 – Final Exam

Question 1:

Answer:

Similarity between live nerve cell and artificial nerve cell:

1. The processing element receives many signals from various sources.
2. Signals may be modified by a weight at the receiving synapse.
3. Under sufficient input or appropriate circumstances, the neurons transmit a single output.
4. The output from a particular neuron may go to many neurons.
5. A synapse's strength may be modified by experience.
6. Both are fault tolerant.

Difference between live nerve cell and artificial nerve cell:

1. Live neuron uses FM or frequency modulation whereas ANN uses discrete signals.
2. Biological neurons work overtime. ANN works on discrete times.
3. Biological neurons get tired. ANN can be excited or brought down repeatedly.
4. Biological neurons can be excited or inhibited by same neurotransmitter. ANN can be trained downward or unlearn. BNN cannot be unlearned, the new path is superimposed on the old one.
5. ANN don't have refractory period. BNN have a refractory period.
6. ANN – Hebbian learning, In biological neurons or BNN's dendrites become stronger with use.

Question 2:

Answer:

There is a lot of similarity the way human auditory system functions and an artificial neural net. Human ear can hear only specific range of frequencies in general i.e. 20 Hz – 20 kHz. Every time we hear a sound of particular frequency, the particular nerve cells in the cochlea get activated and transmit information to the brain to recognize the particular sound and its characteristics. Similarly for ANN, for a specific function, there can be many inputs to the network. Depending upon which is stronger and showing promise, that input is recognized and processed. In time, the dendrites in the human ear nerve cell get stronger in recognizing the sounds. Similarly ANN get stronger in time.

Question 3:

Answer:

Human visual system has similarities with the ANN. ANN can have multiple layers and several neurons at those layers which receive inputs from specific sources. The output from a specific layer goes to a specific layer as well. Similarly LGN in visual system is composed of multiple layers i.e. 6 layers. Different layers have different functions and the output from a layer goes to a specific place. Some directly forward the processed information, some layers provide a feedback. Also, the retina has sensory neurons. According to the amount of light, speed of the object, color etc., the specific neurons are triggered i.e. excited or inhibited and the information is then sent to the brain. Similarly ANNs have multiple neurons performing different tasks and combining the information to reach a decision. Both have the ability to learn.