

ANN- Midterm

2020

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1. Please compare and contrast a human neurologic network to an artificial neural network. What are the similarities and differences? (Min: 200 words - Max: 300 words)
2. Describe the differences between learning with a teacher and learning without a teacher? Which one is the best and why? (Min: 200 words - Max: 300 words)
3. What are the advantages of using an artificial neural network in problem solving in computer science? List and briefly describe each. (Min: 200 words - Max: 300 words)
4. What is the optimum amount of hidden layers in a supervised learning problem such as classifying the mammals, and why? (Min: 200 words - Max: 300 words)
5. What are the function signals and error signals? Describe their relationship with backpropagation.
6. What are learning rules? Which one is best and why?
7. List, describe, compare and contrast the network architectures. Which one is best and why?

1- Please compare and contrast a human neurologic network to an artificial neural network. What are the similarities and differences? (Min: 200 words - Max: 300 words)

Differences between human neurological network and artificial neural network

Brain has more neurons than ANN. However, sometimes increasing the number of neurons does not lead to better results. Although human neurologic network is highly complex, it consumes very little energy compared to ANN's training sessions so, HNN is more efficient. In ANN layers can not connected to neighbors, in HNN neurons connected asynchronously. They can fire up in parallel. Another difference is when ANN fully trained it will never forget it, but human's knowledge is permanent. Our knowledge can deepens on old ones but ANN have a predefined model, so we can't add new connections. However, ANN can change the weights during the training. Also method of learning is different. We have to recall the information to learn in the brain, ANN learns during the training. We can transfer the optimum model weights to a system but brain have to learn starting from zero.

Similarities between human neurological network and artificial neural network

First similarity is existence of neuron structure. Weights in ANN is synapses in biological neural networks, also axons are equal to our outputs. The way of learning at a very abstract level is same that knowledge is obtained from the environment by the network.

2- Describe the differences between learning with a teacher and learning without a teacher? Which one is the best and why? (Min: 200 words - Max: 300 words)

1. You have input and output examples in learning with a teacher, it means teacher know the knowledge of environment. So, we have a guide to learn. But we don't use output data, in learning without teacher. We have to learn by the network.
2. We use teacher for off-line analysis. Without a teacher we can analyse real time data.
3. Number of classes are set by a teacher when learning with teacher. But without teacher we don't know data classes in first place so categorization of data will appear end of the learning without teacher.
4. With teacher experiment we optimize the performance of ANN.
5. Sometimes, there is no teacher to lead you to desired output. So learning without teacher is easier to apply in real life. You don't need to determine the features.
6. We can detect some unknown patterns in learning without teacher, it leads to new views and analysis.

We can't say that one is better than the other. We should use them together. Feature extraction can be very problematic in real life applications so, we need to learn without a teacher to detection of features. Then, we should use learning with a teacher for classification part. Thanks to teacher's reward or punishment, we can optimize our model.

3- What are the advantages of using an artificial neural network in problem solving in computer science? List and briefly describe each. (Min: 200 words - Max: 300 words)

1. ANN can deal with the complex problems that involves too many variable. Its high speed for solving the complicated relations is very important against the traditional methods. In addition it have the ability to parallel computing. Computations for each node is independent to the others. Without this, the training would take long time.
5. ANN have the capability of fault tolerance. Some cells can not be used because they are damaged. However, it don't prevent to reach the result. And thanks to the storage of information on the network, if some informations disappear, it doesn't stop the entire system.
2. ANN can learn itself without a teacher. Feature extraction is taking very long time for a human. But ANN can do it without any information of data. Also it can detect the certain patterns.
3. It is not a system limited by inputs. ANN produces correct results on similar events. It means that ANN can generalize its inputs.

4. ANN can reach the connections between data points. It leads to find many valuable shortcuts instead of long and difficult computations.

6. ANN can handle with non-linear problems.

7. ANN can work with insufficient knowledge. But it affects the accuracy of model.

4- What is the optimum amount of hidden layers in a supervised learning problem such as classifying the mammals, and why? (Min: 200 words - Max: 300 words)

We are trying to build a network that learn the classification of mammals. If our problem was that a single feature could be separated linearly, we would use a single hidden layer. However, the problem requires more than one separation. We can classify them to look their masses, but we still have two noisy groups. Then, we should add a one more hidden layer to decide their geographic range. After this addition, we still have large groups with different properties so, we will add the two more layer. First one is looking for density, second one is for mass-specific production. We should add 4 more hidden layer for their group sizes, habitat modes, activity periods and landmass types. In each layer we shouldn't use few neurons, because it can cause underfitting. If we use too many neurons in each layer, it is a problem too. We don't want to overfitting in our network. Also, calculations of large number of neurons take long times. To sum up, in our example we used 8 hidden layer for classification. If we have a simple dataset, two or less layers we can use. But, complex data sets need more hidden layers. Additional layers will help us to classify more accurately if we have too many classes.