**Graded Discussion 2**

Extracting powerful feature maps from unstructured data is a key step in building effective machine learning applications. Accurate function approximation is only possible with a good feature map. Fully connected NNs can create powerful feature maps, but at the expense of a large number of weights which must be learned. Whereas, CNNs can learn powerful feature maps with a limited number of parameters.

Please consider an application of machine learning to unstructured data you are interested in. What is the application? At least conceptually, considering issues of scale, complexity and difficulty of learning, how can you envision CNNs working to create the feature map. If you can find examples of suitable CNNs used to create the required feature map, or something similar, please share them.

For this topic, make a post of about 100-300 words here in Piazza. Then post a comment of suggestion on another students post of about 100-200 words.  Posts are due by April 25. Do not post respond in Canvas.

As mentioned in the previous discussion of the applications that I would like to explore at work is a model that can detect the type of damage we see in a picture for a metallic detail part of an airplane during the manufacturing process of new airplane (as this is the case at Boeing). This would not be a detection of damage on the airplane itself but on the metallic detail parts at the moment they are created or put together as details. The system would consist of a set of cameras taking pictures at different moments during the process cycle of these parts (when receiving the raw material, after the part is bend/cut, after details and finishes are added, etc.). The CNN would look at the picture and try to find feature maps to differentiate cracks, from scratches, from gauges (tool marks, dents), drill starts, etc. Potentially the convnet would be able to map that if the damage comes in strain line shapes it might be a scratch, or if it is a connected line that behaves in a periodic way (up and down) that could be a crack, or if the damage is presented with circular patterns that might be a gauge coming from a tool mark, or maybe a dent.

As I was looking into this topic I found an article for a similar problem where the goal was to find scratches metal surfaces and for example and after some experimentation they decided to a ResNet model with an architecture of 50 & 152 layers (ResNet50 & ResNet152) for the Convolutional Neural Network. This is great news as potentially this could be used by using the transfer learning property of the machine learning models.

Reference:

Konovalenko et al. March 2021. “Recognition of Scratches and Abrasions on Metal Surfaces Using a Classifier Based on a Convolutional Neural Network” (https://mdpi-res.com/d\_attachment/metals/metals-11-00549/article\_deploy/metals-11-00549.pdf?version=1617937500)