**Graph Neural Networks – Overview**

* GNNs are neural networks that can be directly applied to graphs
* provide an easy way to do **node-level, edge-level, and graph-level** prediction tasks
  + Node Classification: labeling of samples, semi-supervised usually
  + Graph Classification: classify the whole graph into different categories
  + Link prediction: predict whether there’s a connection between two entities
* CNNs fail on graphs
  + Convolution and pooling layers to identify spatially localized features
  + center node of center pixel aggregates information from its neighbors, as well as from itself, to produce a new value.
    - very difficult to perform CNN on graphs because of the arbitrary size of the graph, and the complex topology, which means there is no spatial locality
* GNNs goal is to map nodes so that similarity in the mapped embedding space approximates similarity in the network
  + Encoding functions to convert from input to d-dimensional embedding space. It performs:
    - Locality (local network neighborhoods)
    - Aggregate information
      * Done using NNs
    - Stacking multiple layers (computation)
* Training
  + Unsupervised: use only the graph structure
  + Supervised: node classification, normal or anomalous node