1) Please explain the pros and cons of Instance-Based Learning and Model-Based Learning respectively. (7 points)

* Instance Based Learning:

→ It is a supervised learning algorithm, that performs operation after comparing the current instances with previously trained instance, which have been stored in memory. Time complexity is O(n).

Pros:

→ It is mostly useful in online learning where examples are generated in runtime. A new addition of data is just an update to existing database.

Cons:

→ Slow at query time

→ Can be easily fooled by irrelevant attributes.

* Model based Learning:

→ In this type of learning, machine seeks to create a bespoke solution tailored to each new problem

Pro's:

→ It is easy for data exploration and can be trained from simulated experiences.

→ It needs few examples to learn from.

Cons:

→ It is complex in terms of computations

→ In some cases it can be difficult for a model to learn.

2) Explain what is Distance Weighted kNN. (5 points)

Solution:

→ Weighted KNN is a modified version of k-nearest neighbours.

→ One of the many issues that affects performance of KNN is the choice of hyper-parameter 'k'.

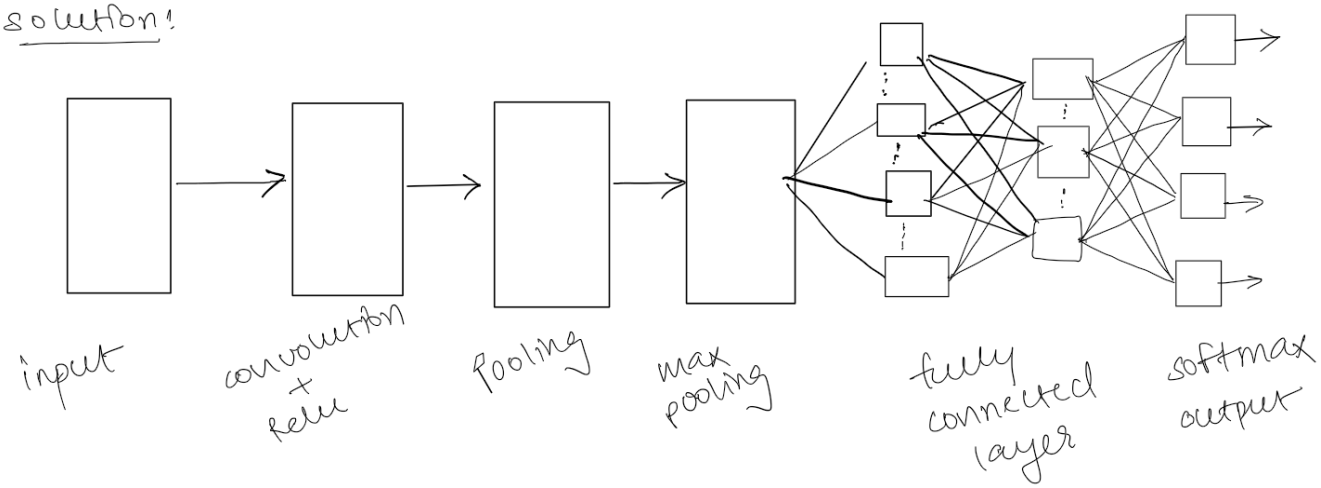
→ If k is too small, algorithm would be more sensitive to outliers.

→ If k is too large, the the neighbours may include too many points from other classes.

> The weighted neighbours is aim to improve classification problem. It does so by reducing the sensitivity of solution of neighborhood size

3) Please draw the diagram of Convolutional Neural Networks (CNN). Then explain the functionality of each layer of CNN. Name several latest algorithms of CNN (e.g., AlexNet). (10 points)

solution:



* Convolution Layer:

→ This is first layer to extract features from image.
> extract features using filters.
> filters are composed of small kernels learned
→ one bias per filter.
> activation function is applied on every value of feature map.
> I/p : 3D cube, previous set of feature maps.
O/p : 3D cube, 2-D map per filter.

* Pooling Layer:

→ Pooling layers are similar to convolution layers, but they perform specific function such as, maxpooling which takes maximum value in a certain filter region, or average pooling, which takes average value in a filter region. These are typically used to reduce the dimensionality of the network.
> It reduce dimensionality.
> uses sliding windows approach.

* fully connected layer:

→ This layer is placed before classification of CNN and are used to flatten the results before classification
→ This is similar to output layer of MLP.

* CNN Algorithms:

1. AlexNet
2. ColorNet
3. LeNet
4. ResNet
5. GoogleNet