Create a word document that explains what all five the concepts or ideas listed below mean, roughly one paragraph per topic.

1.) Residual models- related to the idea of layer skipping, discussing why this works

Residual models are when you add a skip connection so add input X to the output of the network. The goal of training a neural net is to make the target function h(x) however in this case it becomes h(x)-x. The resulting network initially outputs a copy of its inputs, so it initially models the identity function. If the target is close to the identity function then the training process will be sped up considerably. You can add many skip connections and the network will start making progress even if there are layers that haven't started learning yet. Thanks to skip connection the can fire through the whole network very easily.

2.) Data Augmentation- generating variations on data to allow for more variation in training data.

Data Augmentation artificially increases the size of the training set by generating many realistic variants of each training instance. This helps reduce overfitting so it’s a form of regularization training. Ideally augmentation should not create instances where the human can clearly tell that it was augmented.

3.) Transfer learning- reuse of neural net layers

If you want to build an image classifier but you do not have enough training data, then you can reuse the lower layers of a pretrained model. An example would be to load an Xcepton model, pretrained on ImageNet. We first exclude the top layer by setting include\_top = False. We then add our own top layer based on the output of the base model, followed by a dense output layer with one unit per class. Then create the Keras model. Then freeze the weights of the pretrained layers, after which we can compile and start training the model. After which you can unfreeze all the layers and continue training with lower learning rates to preserve pretrained weights until we have an acceptable model accuracy.

4.) Image segmentation- determining where objects in images are located

In semantic segmentation each pixel is classified according to the class of the object it belongs to for example car, pedestrian and tree. Different objects of the same class are not distinguished. The main problem with this is that when images go through a regular convolutional neural network they decline in spatial resolution. This is a problem with many solutions however, some more complex than others.

5.) GAN- Generative Adversarial Learning, and image generation

The goal of generative modeling is to identify patterns in input data which will be used to create new examples that resemble the original dataset. GANs are made up of two neural networks, a discriminator and a generator. In this process the generator tries to generate images which are very similar to that of the original dataset and also attempts to fool the discriminator. The discriminator is tasked with taking in two inputs one from the main dataset and other from images generated from the generator, then it must accurately identify what is genuine data and what is produced.