Notes -

Flower Dataset -

Morphological Transformations -

1. Thresholding

convering RGB to Gery scale; threshold intensity above is 1 and below is 0

2. Erosion

Shrinks bright parts, enlarges dark parts

3. Dilation

shirnks dark parts, enlarges bright parts

4. Opening

Erosion followed by dilation

Remove small bright parts

5. Closing

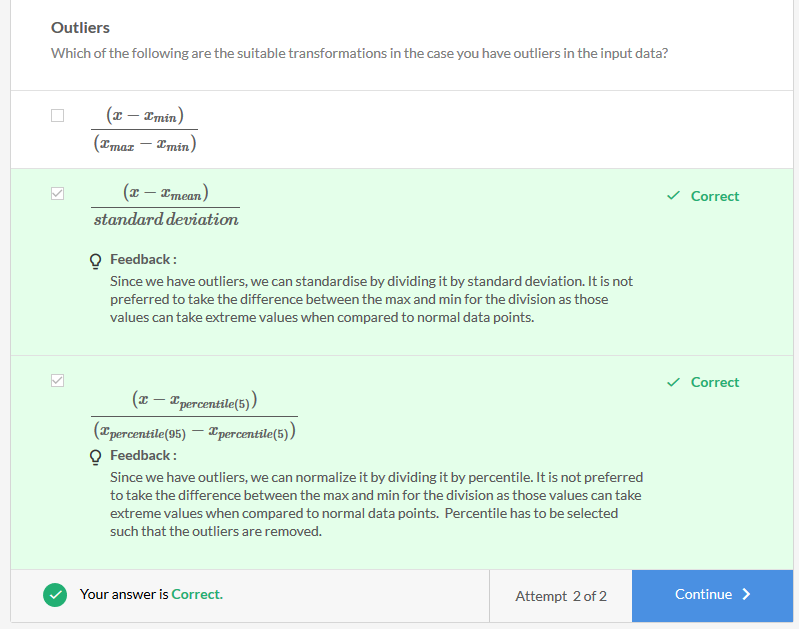
Dilation followed by erosion

rmemoves small dark parts

Normalisation makes the training process much smoother. This is an important preprocessing step, so let's discuss it briefly.

Formula for normalisations are:

* (image−np.min(image))/(np.min(image)−np.max(image))
* (image−np.percentile(image,5))/(np.percentile(image,95)−np.percentile(image,5))



1. Reasons for Normalisation

* Contrast and lighting conditions
  + We need to account for variation in pictures, or different settings of machines taking images
* Gradient Propagation
  + Normalised images make for much better gradient propagation

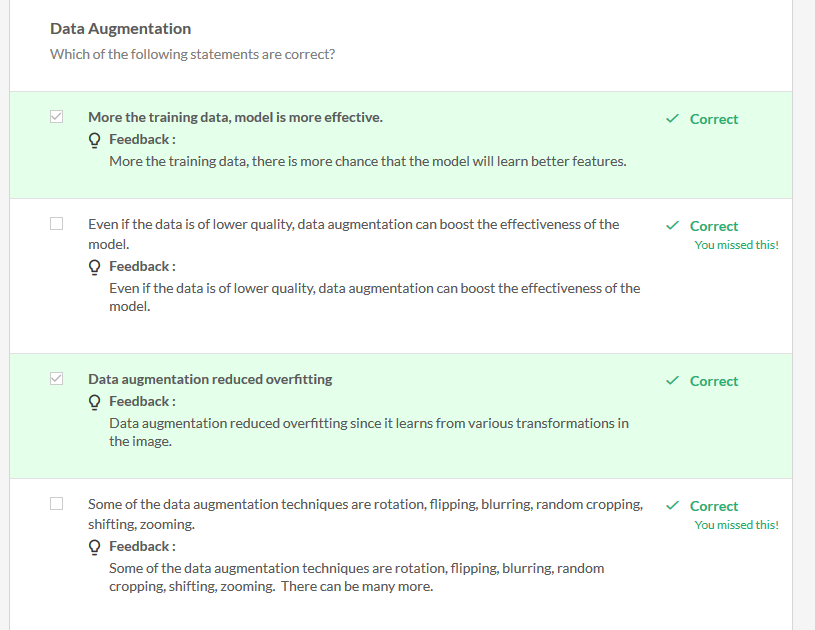
**Data Augmentation -**

creating extra data out of existing data.

Types:

1. Linear Transformation
   1. Matrix operations
      1. Rotation
      2. Flipping
2. Affine Transformations
   1. Translation followed by Linear Transformations

pooling increases the Invariance (Pooling is the process of extracting the features from the image output of a convolution layer. This will also follow the same process of sliding over the image with a specified pool size/kernel size. Max Pooling is being used widely and it will just keep the highest number in the pool and discard the rest)



Hyperparameter Tuning

* Learning rate & Variation and Different optimizers
* Different types of Augmentation

**Summary**

In this session, you learnt to set-up a typical end-to-end pipeline for training CNNs. Specifically, you learnt the following:

**Data Preprocessing**

**Morphological Transformations**: This refers to changing the shape and size of images. The typical transformations are erosion, dilation, opening and closing.

**Augmentation**: Refers to making changes related to rotation, translation, shearing, etc. Augmentation is often used in image-based deep learning tasks to increase the amount and variance of training data. Augmentation should only be done on the training set, never on the validation set.

**Normalisation**: Refers to rescaling the pixel values so that they lie within a confined range. One of the reasons to do this is to help with the issue of propagating gradients.

**Network Building**

Choosing the architecture: For this demo, we used the 'ResNet' architecture. Its biggest upside is that the 'skip connections' mechanism allows very deep networks.

**Ablation Experiments**: These refer to taking a small chunk of data and running your model on it - this helps in figuring out if the model is running at all.

**Overfitting on Training Data**: This tells you whether the model is behaving as expected or not.

**Metrics**: Depending on the situation, we choose the appropriate metrics. For binary classification problems, AUC is usually the best metric.

**Hyperparameter tuning**: We tune hyperparameters such as the learning rate, augmentation of images, batch size, etc. Also, we only change the architecture of the network if we have already tried tuning all other hyperparameters.

1. Data Preparation:
   1. Made sure all our images were of the same resolution.
   2. Placed the images in two different folders - 'rose' and 'daisy'. This method will work for any application where you're trying to train using images.
2. Data Pre-processing: Morphological Operations
   1. Did thresholding on the image - converted it from a grey image to a binary image.
   2. Looked at Erosion, Dilation, Opening, Closing.
3. Data Pre-processing: Normalisation
   1. Understood the need for normalisation.
   2. Saw some commonly used methods of normalisation.
4. Data Pre-Processing: Augmentation
   1. Understood the need for data augmentation.
   2. Learnt about two types of transformations for augmentation - linear and affine.
   3. Saw different ways to augment - translation, rotation, scaling, etc.
5. Model Building
   1. Running ablation experiments
   2. Overfitting on a smaller version of the training set
   3. Hyperparameter tuning
   4. Mode training and evaluation

**Application to Chest X-rays**