Foundations of Deep Learning

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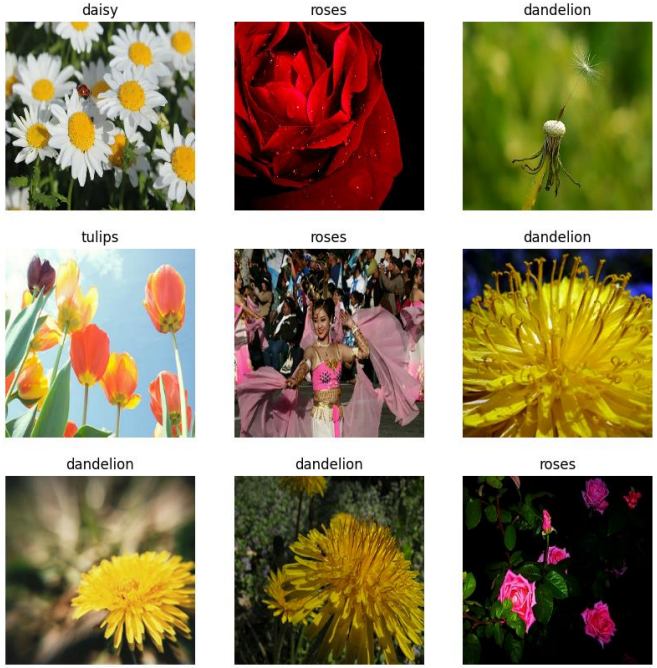
Image Classification : Flowers Dataset

- 3670 RGB images of different size
- Images format : .jpeg
- Five classes of flowers
- Number of images per class:
  - Roses → 641
  - Tulips → 799
  - Daisies → 633
  - Dandelions → 898
  - Sunflowers → 699



Data Preprocessing

- The training set is composed of 227x227 pixel images, shuffled with a fixed seed and 32 samples in each batch are used for training.

- The validation set is composed of 227x227 pixel imaged corresponding to 2/3 of 20% of the original dataset; images are shuffled with a fixed seed and 32 samples in each batch are used for validation.

- The test set is composed of 227x227 pixel images, corresponding roughly to 1/3 of 20% of the original dataset; images are shuffled with a fixed seed and 32 samples in each batch are used for validation.

- Splitting
  - Training : 80%
  - Validation : 13%
  - Test : 7%

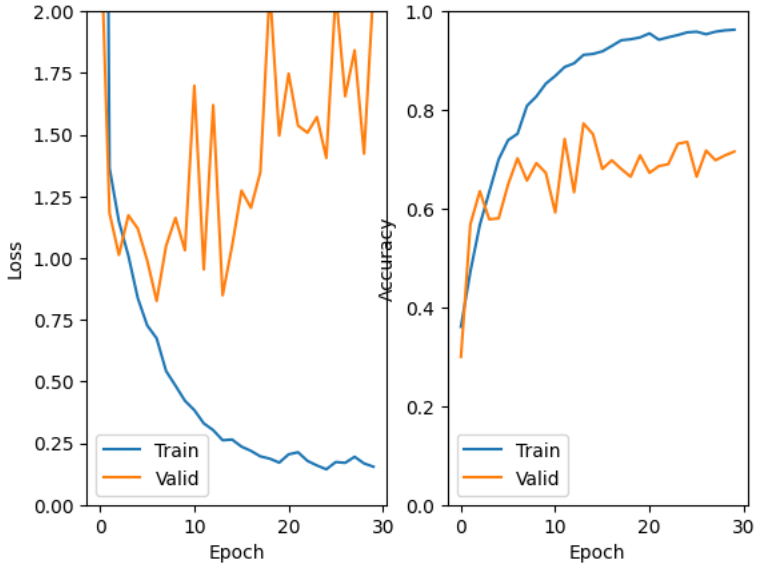
First Model

- Padding : **'same'**;
- **2D Convolutional Layers** : **(1)** 32, **(2)** 64, **(3)** 128

  Activation Function : **ReLU**;
- MaxPooling2D : of size 3x3 after the first two convolutional layers with **'strides=3'**;
- GlobalMaxPooling2D : after convolutional layer **(3)**;
- Fully Connected Layer

  Activation Function : **softmax**
- Optimizer : **RMSprop**
- Learning Rate : **0.001**
- Metric : **accuracy**

- Training Set Loss : 0.154
- Train Set Accuracy : 0.962
- Test Set Loss : 1.968
- Test Set Accuracy : 0.687

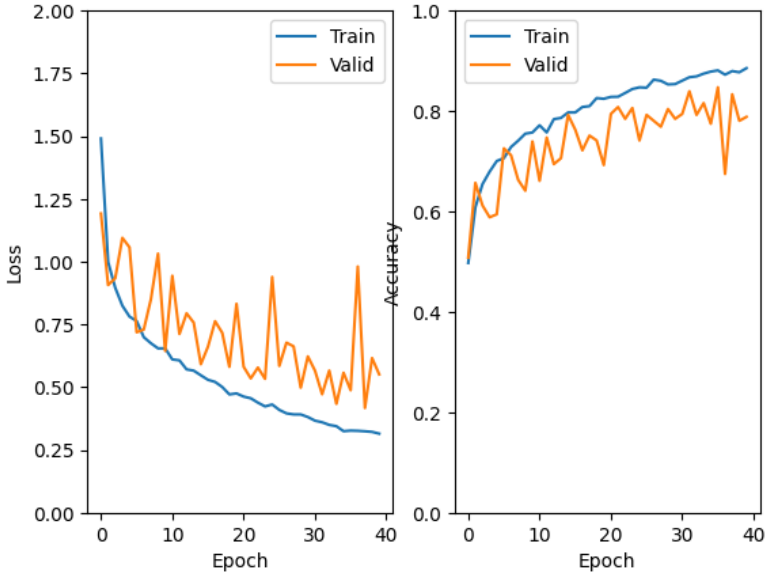


Data Augmentation

- Data Augmentation techniques have been applied to the input layer of the neural networks in a sequence:
  - Random Crop → 224 x 224
  - Random Flip → Horizontal
  - Random Contrast → 0.25
  - Random Zoom → 0.3

Second Model

- Training Set Loss : 0.314
- Training Set Accuracy : 0.885
- Test Set Loss : 0.451
- Test Set Accuracy : 0.816



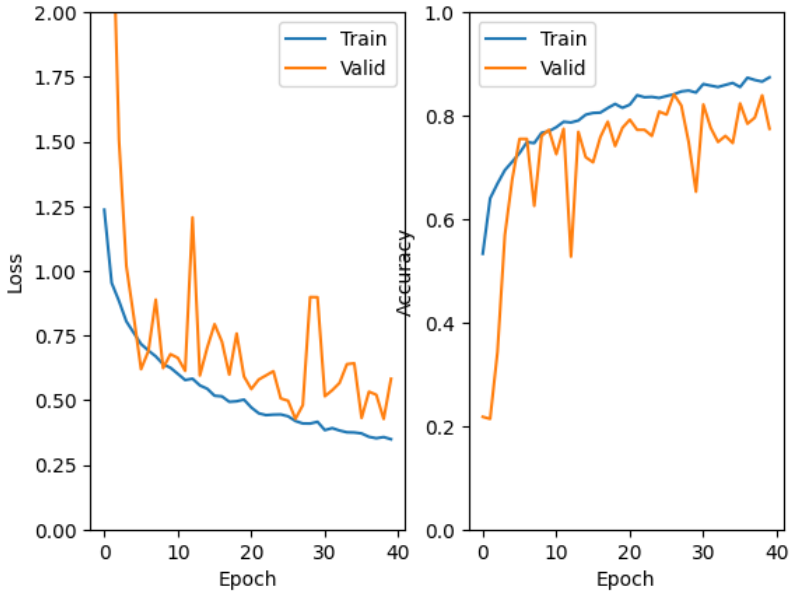
- Data Augmentation
- Padding : **'same'**;
- 2D Convolutional Layers : **(1)** 32, **(2)** 64, **(3)** 128

  Activation Function : **ReLU**;
- Batch Normalization : for the first two Conv2D;
- MaxPooling2D : of size 3x3 after convolutional layers (1) and (2), with **'strides=3'**;
- GlobalMaxPooling2D : after convolutional **layer (3)**;
- Fully Connected Layer

  Activation Function : **softmax;**
- Optimizer : **RMSprop**
- Learning Rate : **0.001**
- Metric : **accuracy**

Third Model

- Training Set Loss : 0.348
- Training Set Accuracy : 0.874
- Test Set Loss : 0.450
- Test Set Accuracy : 0.825

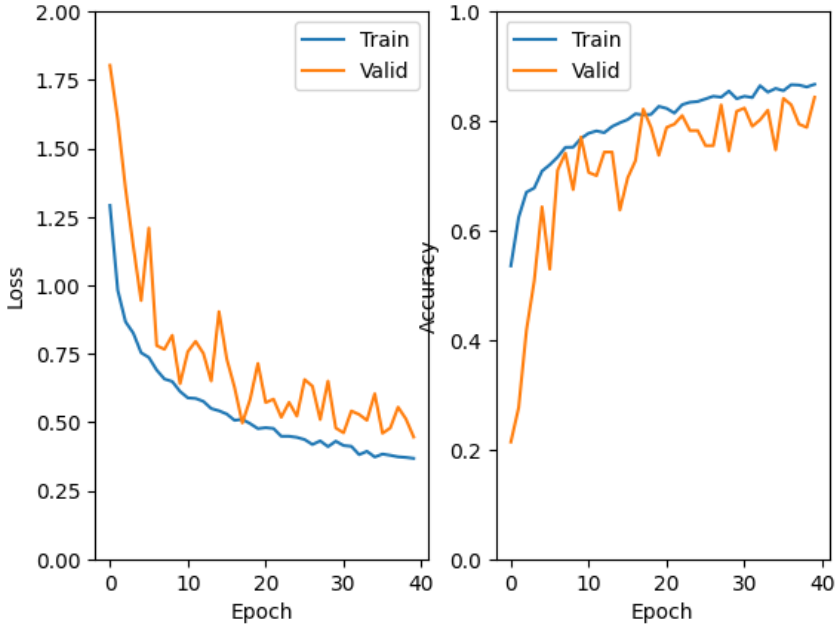


- Data Augmentation
- Rescaling : 1/255
- Padding : **'same'**;
- 2D Convolutional Layers : **(1)** 16, **(2)** 32, **(3)** 64, **(4)** 128
  Activation Function : **ReLU**;
- Batch Normalization : on all the layers;
- MaxPooling2D : of size 3x3 after convolutional layers (1) and (2) and (3), with **'strides=3'**;
- Dropout : at 0.3 on layer (3)
- GlobalMaxPooling2D : after convolutional **layer (4)**;
- Fully Connected Layer
  Activation Function : **softmax;**
- Optimizer : **RMSprop**
- Learning Rate : **0.001**
- Metric : **accuracy**

Fourth Model : The Best Model

- Data Augmentation
- Rescaling : 1/255
- Padding : **'same'**;
- 2D Convolutional Layers : **(1)** 16, **(2)** 32, **(3)** 64
  Activation Function : **ReLU**;
- Batch Normalization : on all the layers;
- MaxPooling2D : of size 3x3 after convolutional layers (1) and (2), with **'strides=3'**;
- Dropout : at 0.3 on layer (3)
- GlobalMaxPooling2D : after convolutional **layer (3)**;
- Fully Connected Layer
  Activation Function : **softmax;**
- Optimizer : **RMSprop**
- Learning Rate : **0.001**
- Metric : **accuracy**

- Training Set Loss : 0.367
- Training Set Accuracy : 0.866
- Test Set Loss : 0.397
- Test Set Accuracy : 0.843



Prediction:
Comparing the Worst and The Best Model

Classes	Precision	Recall	F1-Score
Daisies	0.23	0.24	0.24
Dandelions	0.15	0.12	0.13
Roses	0.12	0.12	0.12
Sunflowers	0.20	0.25	0.22
Tulips	0.22	0.22	0.22

First Model

Fourth Model

Classes	Precision	Recall	F1-Score
Daisies	0.27	0.23	0.25
Dandelions	0.33	0.31	0.32
Roses	0.22	0.26	0.24
Sunflowers	0.13	0.15	0.14
Tulips	0.26	0.23	0.24

Models Summary Table

Models	Test Loss	Test Accuracy
First Model	1.97	0.69
Second Model	0.45	0.81
Third Model	0.45	0.83
Fourth Model	0.39	0.84
ResNet50	0.24	0.91

THANK YOU