

Faculty of Computers and Artificial Intelligence

Computer Science Department

2021/2022

CS 395 Selected Topics in CS-2

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Paper Details

Paper Citation

- **Paper name:** Image Classification Using Convolutional Neural Network ([Link](#))
- **Authors name:**
 - P.Lakshmi Prasanna
 - D.Raghava Lavanya
 - T.Sasidhar
 - B.Sekhar Babu
- **Publisher name:** International Journal of Emerging Trends in Engineering Research.
- **Year of publication:** 10, October 2020

Dataset Used

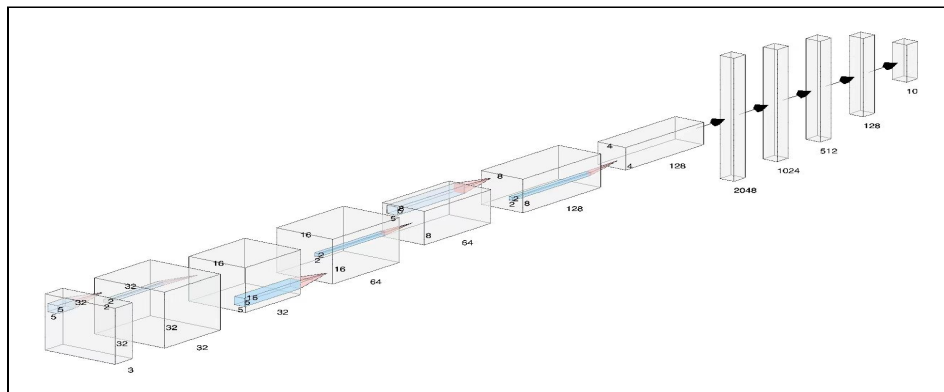
- **The CIFAR-10 dataset ([link](#))**
 - The CIFAR-10 dataset consists of 60000 32x32 color images in 10 classes, with 6000 images per class. There are 50000 training images and 10000 test images.

The implemented Algorithms

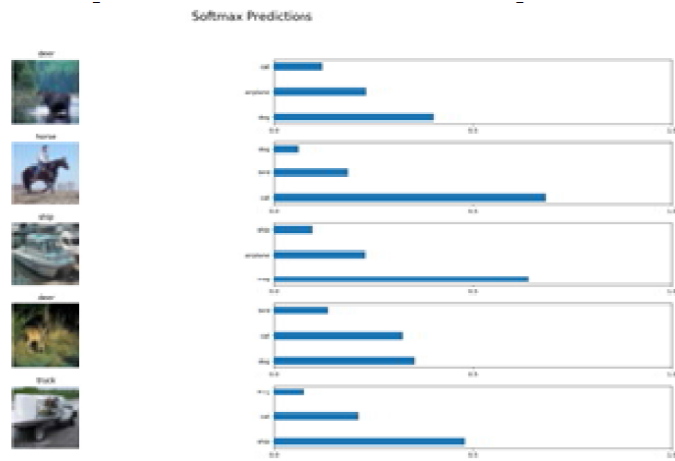
- Convolutional Neural Network (CNN)

Results

- Convolutional Neural Network (CNN) is used for image classification which contains Convlayers to extract features and max pooling to decrease the size of image thus classifying the image accurately. It's implemented using the CIFAR-10 dataset in python



Out of which 50000 are training images and the remaining 10000 are testing images. The figure below is the output of the CNN for Cifar-10 with Epoch size 2.



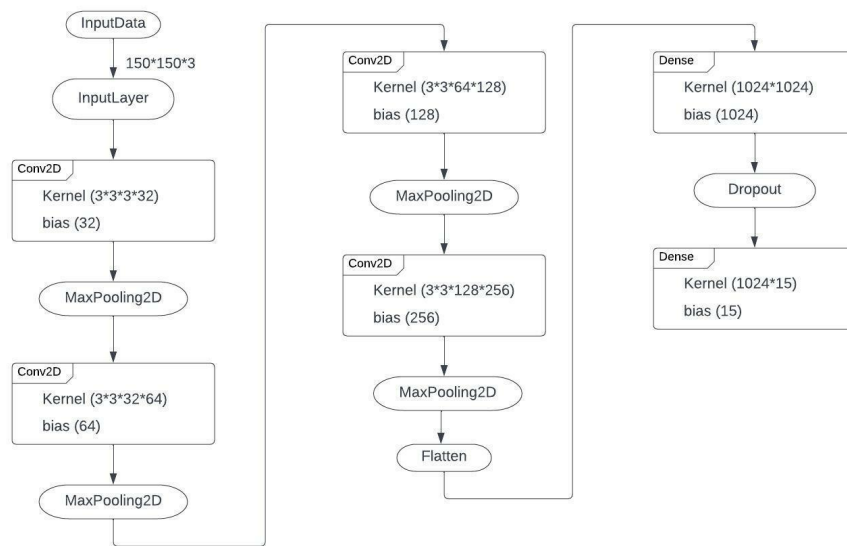
Project Description Document

General information on the selected dataset

- Dataset name: Vegetable Image Dataset ([Link](#))
- Total number of samples in dataset: 21000 images
- Dimensions of image: 244*244 pixel
- Number of classes: 15 class
- Labels:
 0. Bean
 1. Bitter_Gourd
 2. Bottle_Gourd
 3. Brinjal
 4. Broccoli
 5. Cabbage
 6. Capsicum
 7. Carrot
 8. Cauliflower
 9. Cucumber
 10. Papaya
 11. Potato
 12. Pumpkin
 13. Radish
 14. Tomato

Implementation Details

- Training ratio: 70%(approx.) and Number of images is 15000.
- Validation ratio: 15%(approx.) and Number of images is 3000.
- Testing ratio: 15%(approx.) and Number of images is 3000.
- A block diagram of the implemented model to show the main steps:



Implementation of CNN Model

- Hyperparameters used in the model:

Before Enhancement

- epochs = 10
- verbose = 1
- batchSize = 32
- stepsPerEpoch = 15000//batchSize
- validationSteps = 3000//batchSize
- imageSize = 150
- seedNum = 2
- classificationMode = raw
- Optimizer = adam
- Learning_rate = default(0.001)
- loss_function = sparse_categorical_crossentropy
- Padding = same
- strides = 1
- activation = relu, softmax
- Kernel_size = 3
- 2 conv layers
 1. Layer1 filters = 16
 2. Layer2 filters = 32

After Enhancement

- epochs = 20
- verbose = 1
- batchSize = 64
- stepsPerEpoch = 15000//batchSize
- validationSteps = 3000//batchSize
- imageSize = 150
- seedNum = 42
- classificationMode = raw
- Optimizer = adam
- Learning_rate = 0.0001
- loss_function = sparse_categorical_crossentropy
- Padding = same
- strides = 1
- activation = relu, softmax
- Kernel_size = 3
- 4 conv layers
 1. Layer1 filters = 16
 2. Layer2 filters = 32
 3. Layer3 filters = 128
 4. Layer4 filters = 256

Result Details

Before Enhancement

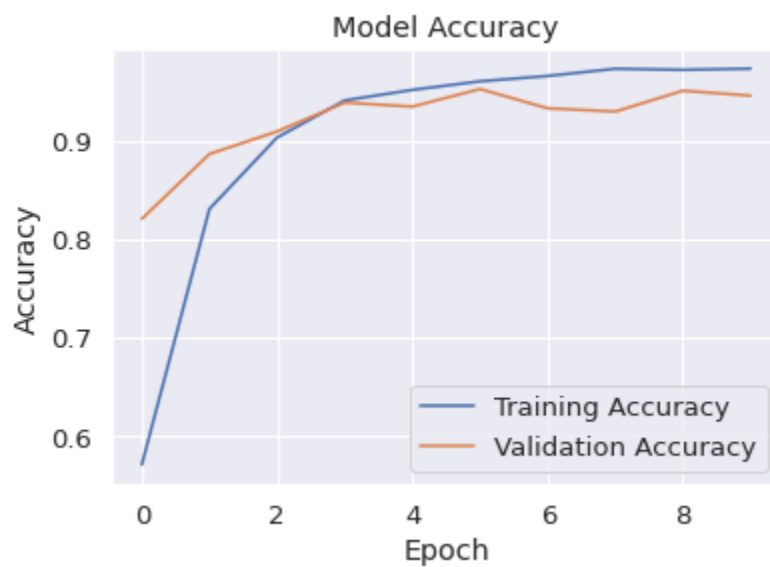
- Accuracy

loss: 19.52%
accuracy: 94.87%

- Loss Curve



- Accuracy Curve



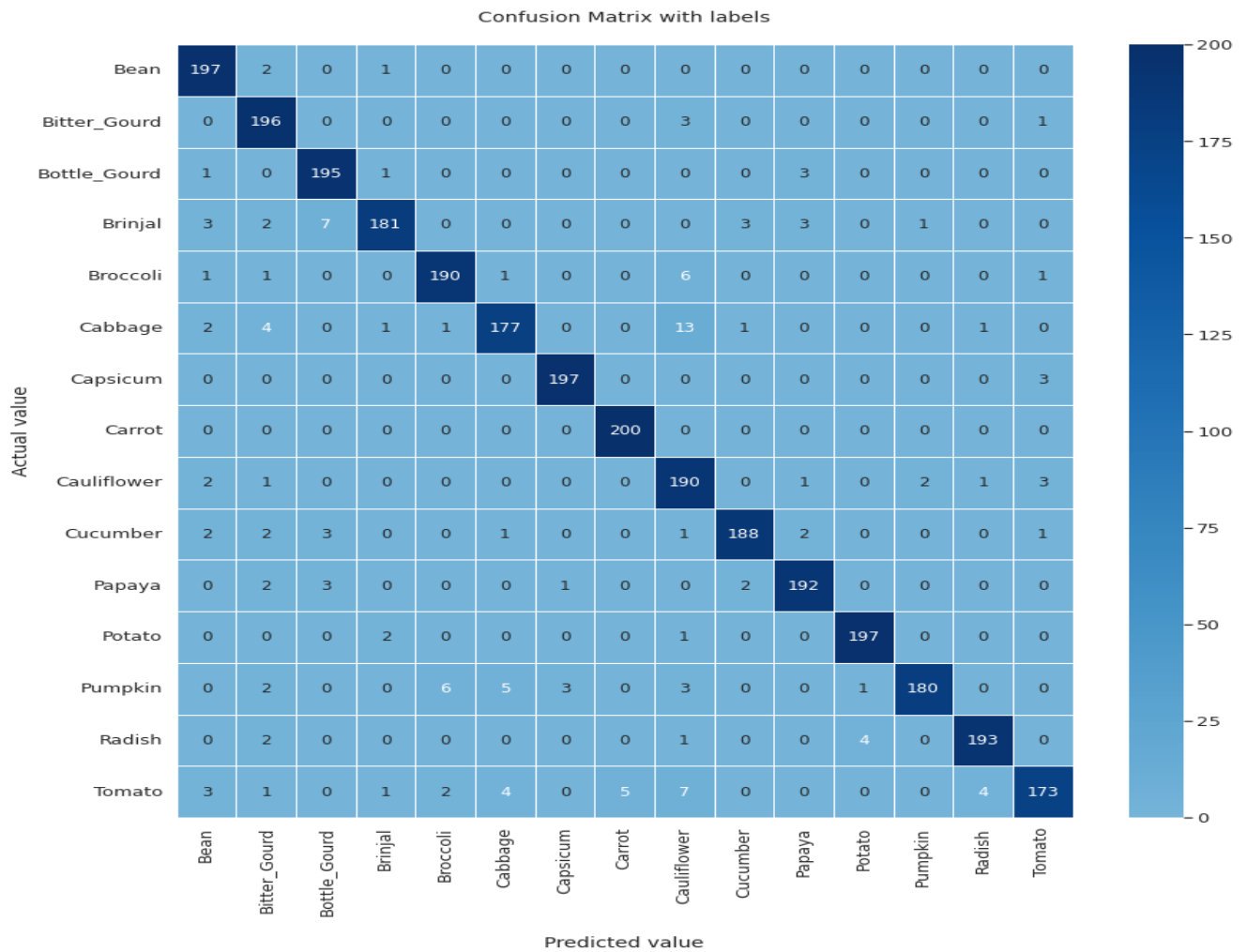
- Classification report

Classification report for classifier <keras.engine.sequential.Sequential object at 0x7f21a41f4280>:

	precision	recall	f1-score	support
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Bean	0.93	0.98	0.96	200
Bitter_Gourd	0.91	0.98	0.94	200
Bottle_Gourd	0.94	0.97	0.96	200
Brinjal	0.97	0.91	0.94	200
Broccoli	0.95	0.95	0.95	200
Cabbage	0.94	0.89	0.91	200
Capsicum	0.98	0.98	0.98	200
Carrot	0.98	1.00	0.99	200
Cauliflower	0.84	0.95	0.89	200
Cucumber	0.97	0.94	0.95	200
Papaya	0.96	0.96	0.96	200
Potato	0.98	0.98	0.98	200
Pumpkin	0.98	0.90	0.94	200
Radish	0.97	0.96	0.97	200
Tomato	0.95	0.86	0.91	200
accuracy			0.95	3000
macro avg	0.95	0.95	0.95	3000
weighted avg	0.95	0.95	0.95	3000

- Confusion matrix

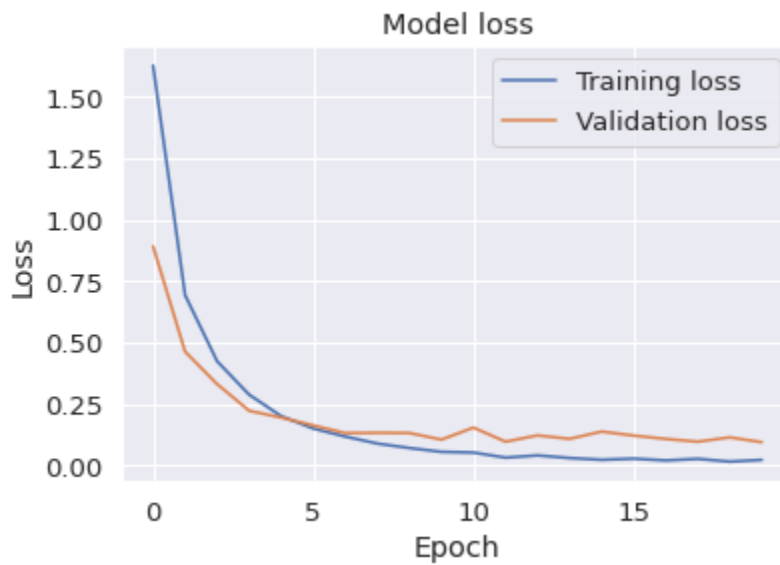


After Enhancement

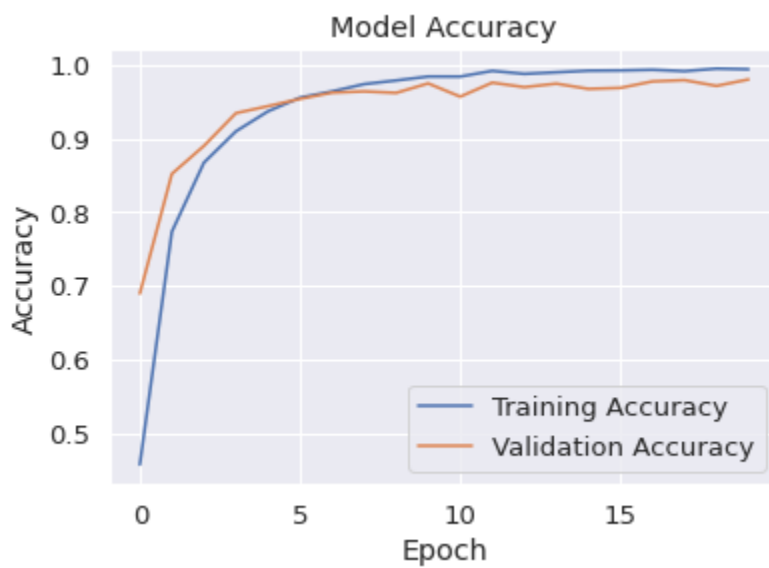
- Accuracy

loss: 9.44%
accuracy: 97.63%

- Loss Curve



- Accuracy Curve



• Classification report

Classification report for classifier <keras.engine.sequential.Sequential object at 0x7f739c5bae50>:
precision recall f1-score support

Bean	0.95	0.99	0.97	200
Bitter_Gourd	0.99	0.97	0.98	200
Bottle_Gourd	0.98	0.99	0.99	200
Brinjal	0.99	0.96	0.98	200
Broccoli	0.98	0.96	0.97	200
Cabbage	0.97	0.95	0.96	200
Capsicum	0.99	0.99	0.99	200
Carrot	1.00	1.00	1.00	200
Cauliflower	0.95	0.95	0.95	200
Cucumber	1.00	0.96	0.98	200
Papaya	0.97	0.99	0.98	200
Potato	1.00	1.00	1.00	200
Pumpkin	0.93	0.96	0.95	200
Radish	0.98	0.99	0.99	200
Tomato	0.98	0.94	0.96	200
accuracy			0.98	3000
macro avg	0.98	0.98	0.98	3000
weighted avg	0.98	0.98	0.98	3000

• Confusion matrix

