Data Science/Machine Learning/Deep Learning Workshop

Nueva Ecija University of Science and Technology (NEUST)

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Day 3 : Image Classification using CNN

Topic 1: Introduction to Convolutional Neural Network
- CNN Definition
- CNN Layers and Architecture
- Convolution Layers
- Pooling Layers
- Training CNN prediction models using predefined image datasets

Topic 2: Data Collection and Custom Image Processing and Labelling
- **Domain Selection and Problem Identification**
- **Cleaning and Pre-processing images**
- **Image Labelling**
- **Training CNN prediction models using custom labelled image datasets**
- **Saving and Loading Prediction models**

Topic 3: Model Evaluation
- Over and Under Fitting Trade-off
- Hyperparameter Tuning Strategies
- The Confusion Matrix

IMAGE PROCESSING

STEPS IN IMAGE PREPROCESSING

There are several preprocessing steps that need to be applied for you to build your own customized dataset.

1. Select the domain of your images
2. Identify the categories covered by the images
3. Collect the image data
4. Rename the image files based on their categories
5. Resize and Grayscale the image data
6. Apply One-hot Encoding
7. Apply Labels to the image data

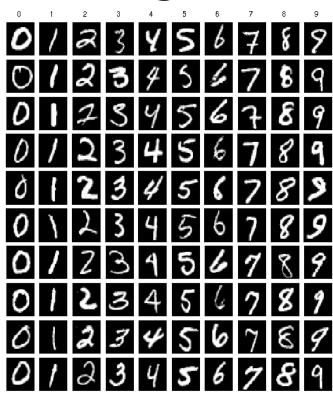STEPS IN IMAGE PREPROCESSING

• Choose a Domain

• Determine the Categories

STEPS IN IMAGE PREPROCESSING

NUMBERS

0 1 2 3 4
5 6 7 8 9

• Collect Image Data
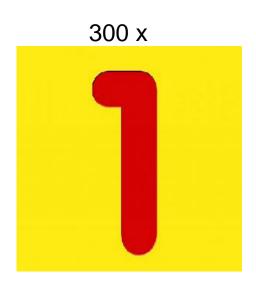
- Rename the Filename according to the Categories

 Zero_001
 Zero_002
 Zero_003
 Zero_004
 Zero_005
 Zero_006
 Zero_007
 Zero_008
 Zero_009
 Zero_010

 One_001
 One_002
 One_003
 One_004
 One_005
 One_006
 One_007
 One_008
 One_009
 One_010

• Resize the Image Data

300 x
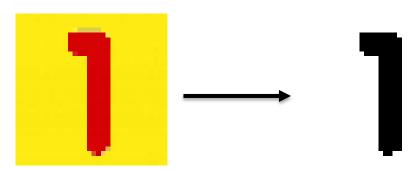
32 x 32

• Convert to Grayscale

Sample Code

```python
imagepath = r"C:\Users\jully ann\Desktop\BabyPics\Baby"
graypath = r"C:\Users\jully ann\Desktop\BabyPics\ProcessedImage"
File_listing = os.listdir(imagepath)
for file in File_listing:
    im = Image.open(imagepath + '\\' + file)
    img = im.resize((32,32))
    gray = img.convert('L')
    gray.save(graypath +'\\' +  file, "JPEG")
```

One-Hot-Encoding and One-Hot Vector

STEPS IN IMAGE PREPROCESSING

```
# create matrix to store all flattened images
hvmatrix = numpy.array([numpy.array(Image.open(r"C:\Users\jully ann\Desktop\BabyPics\ProcessedImage"+
                                    '\\' + im2)).flatten() |for im2 in File_listing],'f')
```

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•Label the Image data

```
label[:100]=0
label[100:200]=1
label[200:300]=2
label[300:]=3
```

```
[0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3]
```

• Shuffle

```
[array([[219., 209., 209., ..., 207., 206., 204.],
        [236., 236., 236., ..., 218., 231., 246.],
        [224., 202., 190., ..., 171., 147., 165.],
        ...,
        [126., 145., 173., ...,  88.,  71.,  48.],
        [255., 255., 246., ..., 202., 195., 196.],
        [176., 171., 175., ..., 242., 241., 247.]], dtype=float32), array([0, 0, 2, 1, 3, 0, 0, 1, 3, 2, 1, 0, 1, 2, 1, 1, 1,
3, 3, 0, 2, 3,
        0, 3, 0, 3, 0, 2, 3, 1, 0, 3, 0, 2, 0, 2, 3, 0, 0, 3, 2, 3, 1, 1,
        1, 3, 1, 3, 3, 1, 1, 2, 1, 3, 1, 0, 1, 2, 2, 0, 1, 3, 2, 2, 1, 2,
        0, 3, 0, 2, 2, 2, 0, 1, 2, 1, 2, 0, 2, 1, 2, 3, 0, 2, 1, 3, 2, 1,
        3, 2, 2, 0, 2, 3, 1, 1, 0, 0, 1, 3, 2, 2, 0, 1, 2, 1, 1, 1, 1, 2,
        3, 1, 2, 0, 2, 1, 0, 3, 3, 0, 1, 2, 2, 3, 3, 0, 1, 3, 2, 1, 2, 0,
        1, 3, 3, 3, 0, 2, 3, 0, 2, 1, 1, 2, 1, 1, 2, 2, 3, 3, 0, 1, 0, 2,
        3, 0, 1, 2, 0, 1, 0, 1, 2, 3, 0, 0, 1, 2, 2, 1, 0, 2, 1, 2, 1, 1,
        0, 2, 3, 1, 2, 0, 3, 0, 3, 3, 0, 0, 0, 2, 2, 0, 3, 3, 3, 1, 2, 1,
        3, 1, 3, 1, 3, 3, 1, 2, 0, 1, 1, 1, 0, 1, 2, 1, 0, 3, 1, 0, 3, 1,
        1, 2, 2, 1, 2, 3, 3, 1, 2, 3, 0, 3, 0, 3, 2, 2, 3, 1, 3, 0, 0, 3,
        0, 3, 2, 3, 3, 0, 0, 0, 3, 3, 1, 0, 1, 1, 1, 2, 2, 2, 1, 2, 1, 3,
        3, 1, 0, 3, 3, 3, 1, 2, 0, 3, 2, 3, 3, 0, 0, 3, 3, 3, 2, 3, 2, 1,
        2, 3, 1, 3, 0, 0, 2, 0, 0, 0, 3, 2, 1, 1, 1, 2, 3, 3, 1, 1, 2, 0,
        2, 2, 3, 1, 1, 3, 0, 2, 3, 2, 3, 3, 0, 1, 0, 0, 3, 3, 0, 0, 0, 3,
        2, 1, 3, 0, 2, 1, 2, 0, 0, 2, 0, 0, 0, 2, 1, 0, 2, 2, 2, 2, 1, 2,
        0, 2, 3, 3, 1, 0, 2, 0, 0, 0, 1, 2, 3, 3, 1, 0, 3, 3, 2, 0, 0, 0,
        3, 0, 3, 2, 1, 1, 1, 2, 1, 1, 2, 2, 3, 0, 2, 3, 0, 1, 2, 3, 0, 2,
        0, 0, 0, 1])]
```

Sample Code

```
imlist = os.listdir(graypath)
num_samples = numpy.size(imlist)
label=numpy.ones((num_samples,),dtype = int)
label[:100]=0
label[100:200]=1
label[200:300]=2
label[300:]=3

data, label = sklearn.utils.shuffle(hvmatrix,label, random_state = 2)
train_data = [data,label]

print(train_data)
```

DEMO TIME

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