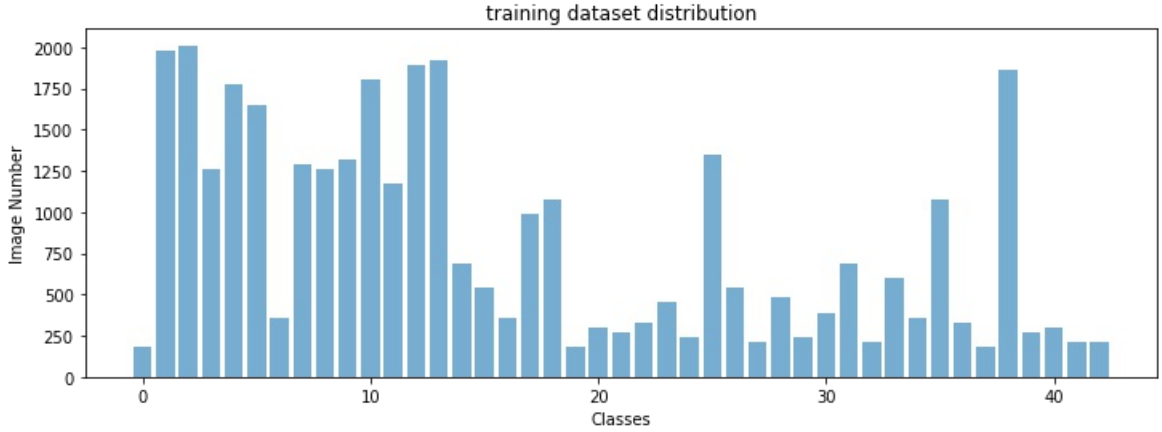
Project: Build a Traffic Sign Recognition

In this project, convolutional neural netw orks (CNN) is applied to German Traffic Sign Dataset and trained modified version of LeNet netw ork to classify them. After the model w as trained, the model w as tested on 7 images w hich founded from internet.

---

sample images are belof for German image dataset

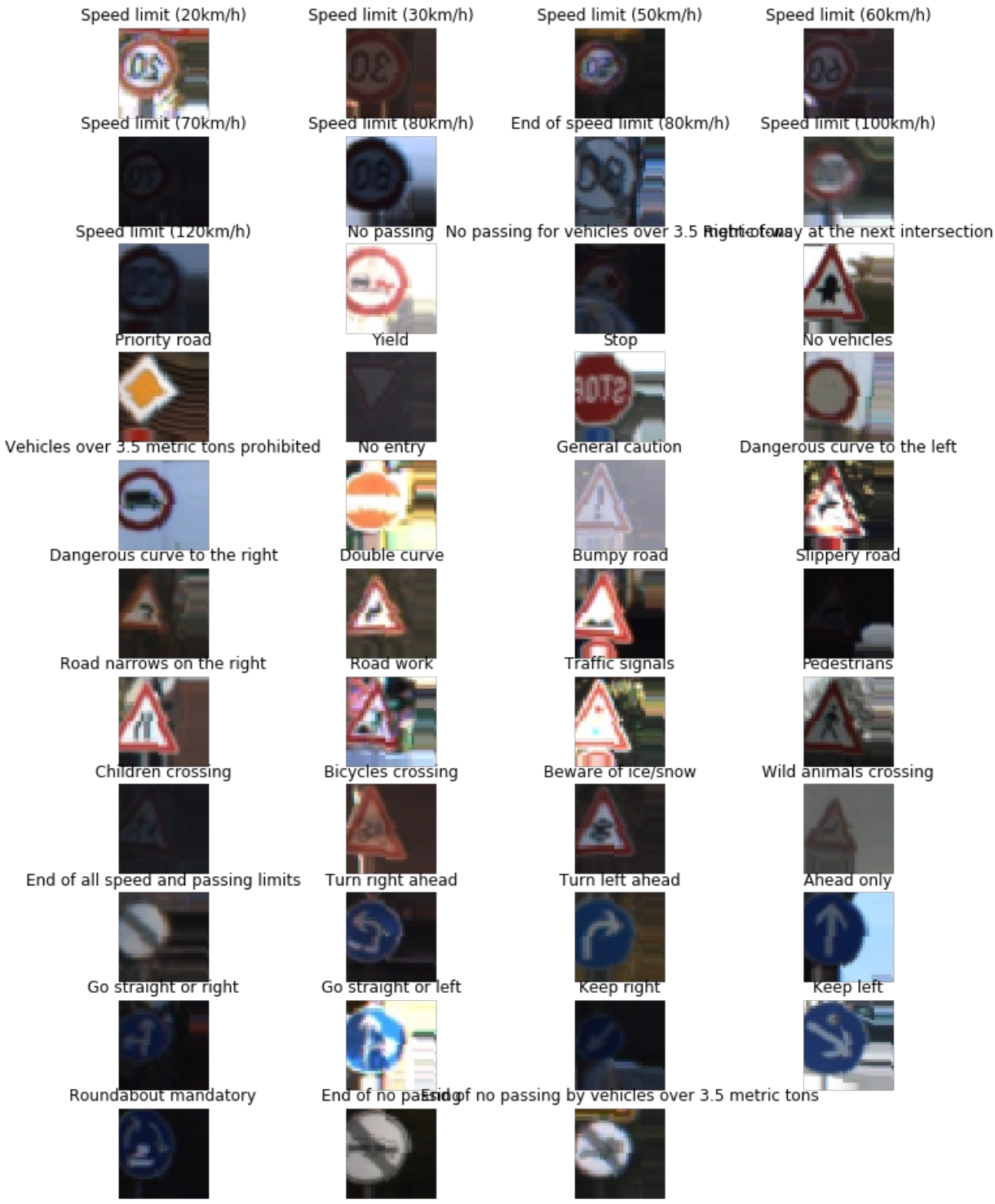
dataset class distrubition is below



By the help of keras image generate class images are augmented. Random augmenteation is used on images and the size of the dataset is increased by the 3 times of real database. For avoiding different result a method w ritten to save the all dataset to folder and read from there w hen needed.

```
X_train_ex = []
y_train_ex = []

def create_data(X_train_ex, y_train_ex, n=3):
    for i in range(0, X_train.shape[0]):
        for j in range(0,n): # Generate n new random transfer images.
            X_train_ex.append(datagen.random_transform(X_train[i,:], seed=1))
            y_train_ex.append(y_train[i])

try:
    with open("train_augmented.pkl", "rb") as f:
            X_train_ex, y_train_ex = pickle.load(f)
            X_train_ex = np.array(X_train_ex)
            y_train_ex = np.array(y_train_ex)

except OSError as err:
    print("train_augment")

    create_data(X_train_ex,y_train_ex)
    X_train_ex = np.concatenate( (X_train_ex, X_train))
    y_train_ex = np.concatenate( (y_train_ex, y_train))

    with open("train_augmented.pkl", 'wb') as f:
        pickle.dump([X_train_ex,y_train_ex], file=f)
```

sample augmented images are below /



and keras ImageDataGenerator class support

I use keras data generate methods to generate new images on existing ones. According to documentation It can augment different images according to fallow ing features.

```
'theta': Float. Rotation angle in degrees.
'tx': Float. Shift in the x direction.
'ty': Float. Shift in the y direction.
'shear': Float. Shear angle in degrees.
'zx': Float. Zoom in the x direction.
'zy': Float. Zoom in the y direction.
'flip_horizontal': Boolean. Horizontal flip.
'flip_vertical': Boolean. Vertical flip.
'channel_shift_intencity': Float. Channel shift intensity.
'brightness': Float. Brightness shift intensity.
```

Architecture

Layer 1: Convolutional. The output shape should be 28x28x24.

Activation Relu activation function is used.

Pooling The output shape should be 14x14x24

Layer 2: Convolutional. The output shape should be 10x10x32.

Activation Relu activation function is used.

Pooling The output shape should be 5x5x32.

Flatten Flatten the output shape of the final pooling layer such that it's 1D instead of 3D.

Layer 3: Fully Connected. This have 800 outputs.

Activation Relu activation function is used.
dropout keep_rate 0.8

Layer 4: Fully Connected. This have 400 outputs.

Activation Relu activation function is used.
dropout keep_rate 0.8

Layer 5: Fully Connected. This have 240 outputs.

Activation Relu activation function is used.
dropout keep_rate 0.8

Layer 6: Fully Connected. This have 120 outputs.

Activation Relu activation function is used.
dropout keep_rate 0.8

Layer 7: Fully Connected (Logits). This have 43 outputs.
Which after each fully connected network dropout out layer is used for regularization.

Training is done with Adamoptimizer and different learning rate is checked for optimum result. Extended version of the dataset is used for showing result of generating augmented images. It can expand the capability of the network in term of scale, rotation etc. Approximately 95 validation and test accuracy is achieved.

---

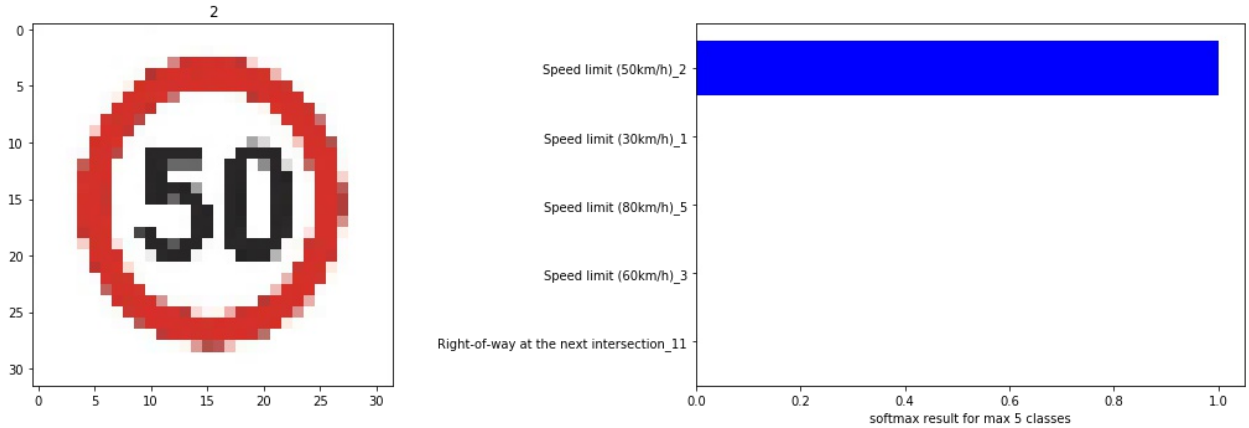
7 sample image is downloaded from internet and labelled accordingly. Below sample images.

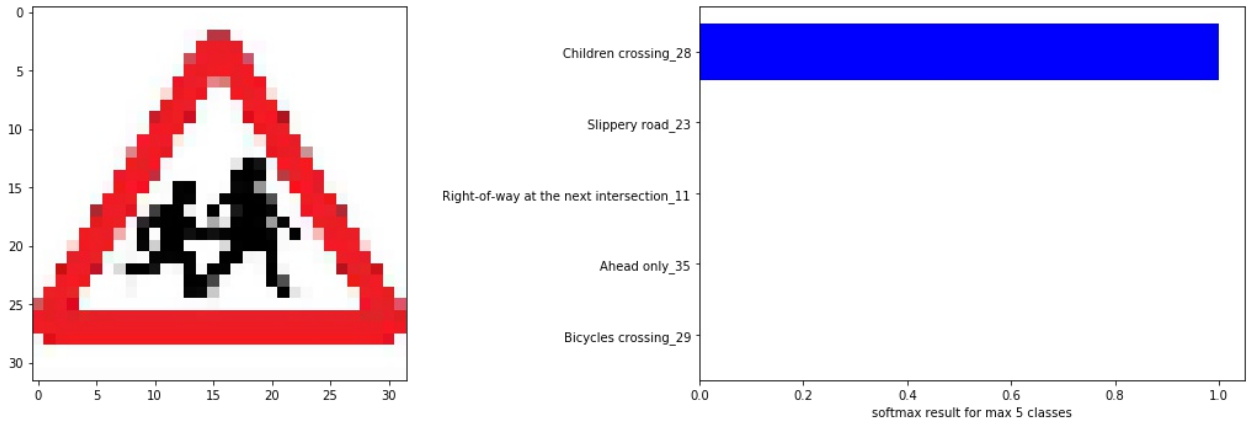


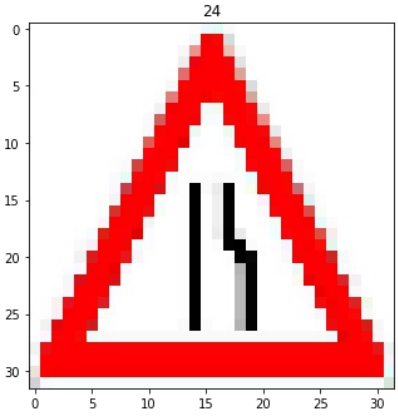


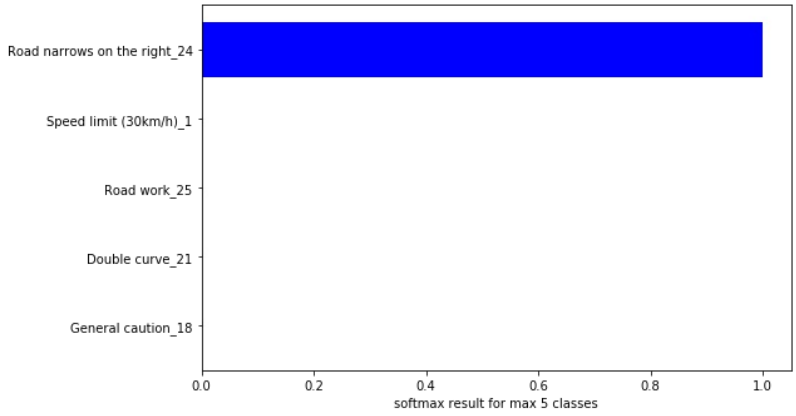


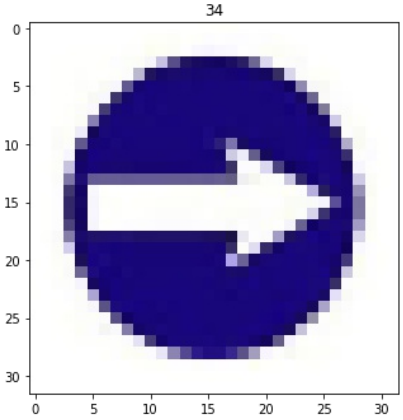
and netw ork classification result can be seen below.

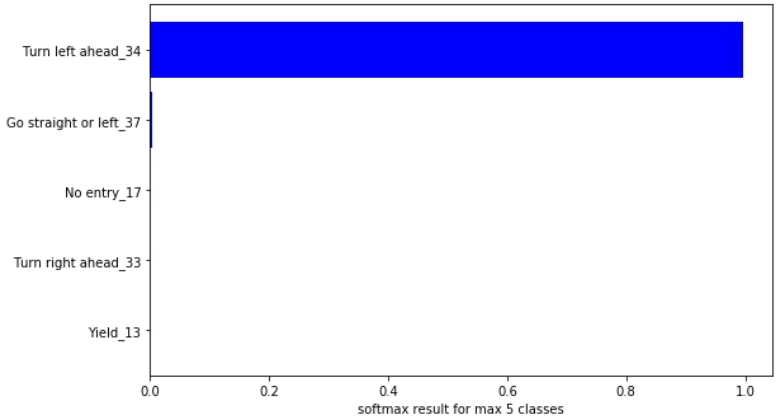


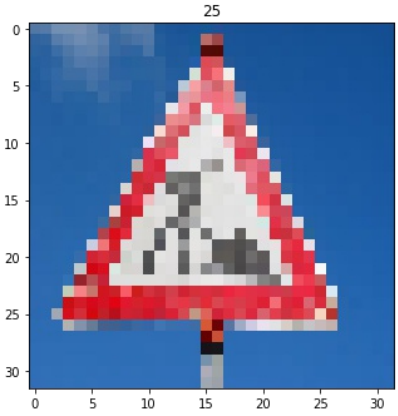


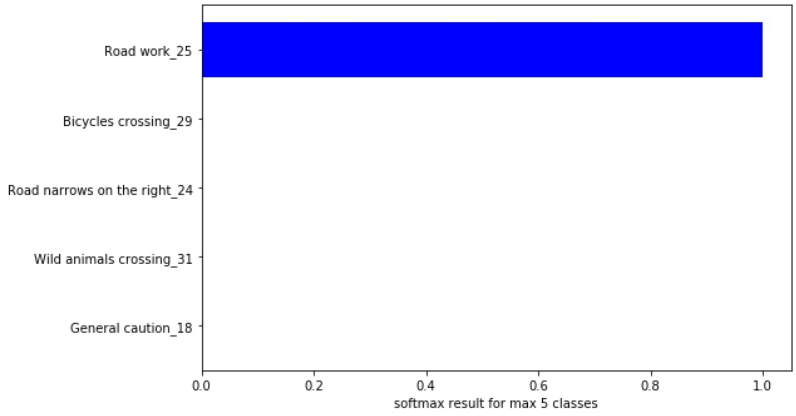

24

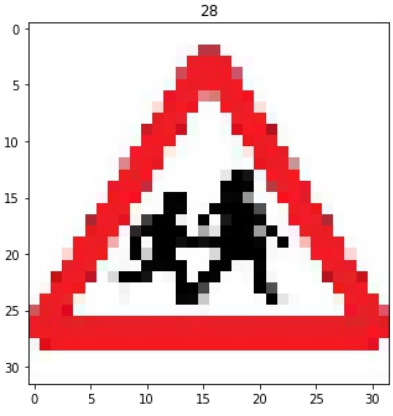

Road narrows on the right_24
Speed limit (30km/h)_1
Road work_25
Double curve_21
General caution_18
softmax result for max 5 classes

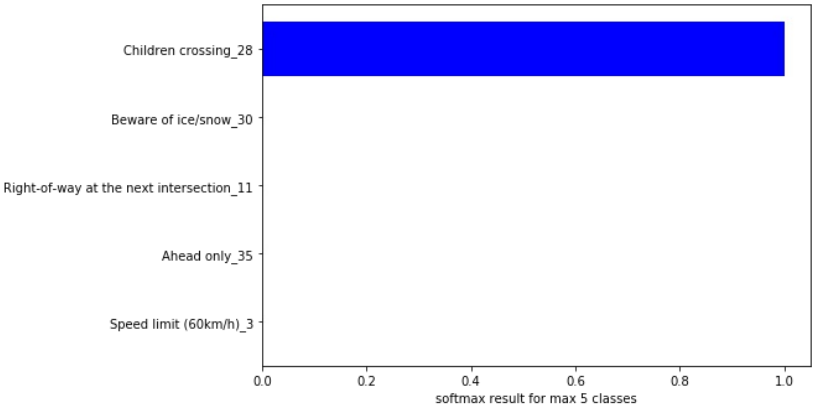

34

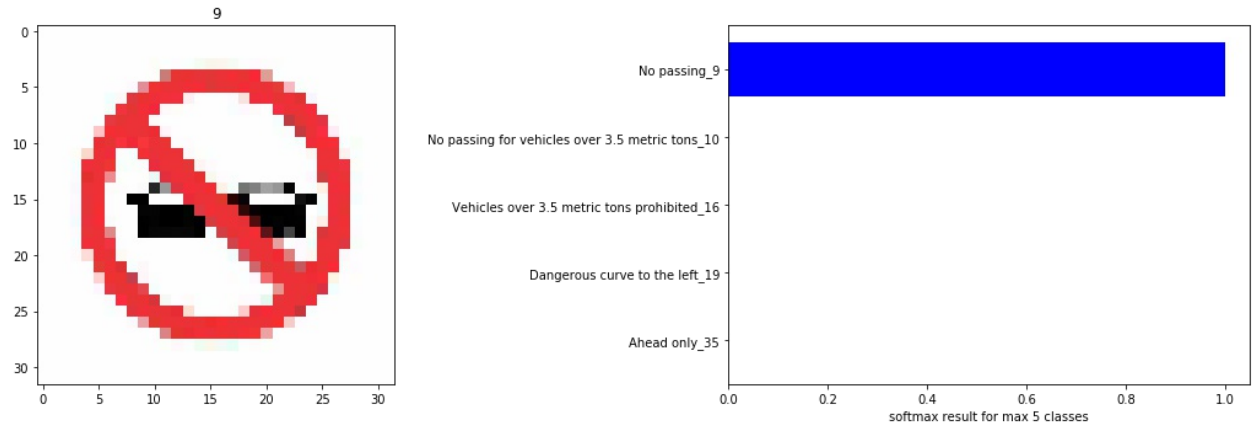

Turn left ahead_34
Go straight or left_37
No entry_17
Turn right ahead_33
Yield_13
softmax result for max 5 classes


25


Road work_25
Bicycles crossing_29
Road narrows on the right_24
Wild animals crossing_31
General caution_18
softmax result for max 5 classes


28


Children crossing_28
Beware of ice/snow_30
Right-of-way at the next intersection_11
Ahead only_35
Speed limit (60km/h)_3
softmax result for max 5 classes



and visualization result can be seen below conv layer one and conv layer 2 is used for visualization.