Weather Image Recognition

Deep Learning for AI

Dew

Fog / Smog

Frost

Glaze

Hail

Lightning

Rain

Rainbow

# Rime

Sandstorm

Snow

Data preprocessing

- 6,862 images → **split** into 80% training / 10% validation / 10% test

- Class unbalance: in training set the smallest class is rainbow with 187 images and the largest one is rime with 949 images → I will use **class weights** during training

- Transform all images to dimension **3 x 224 x 224** and to tensor

- **Data augmentation**: apply some transformations to some randomly selected training images to help the model generalize better and perform well on unseen images

  ➢ Random Horizontal Flip: flips the image horizontally with a 50% probability
  ➢ Random Rotation: randomly rotates the image by up to ±15 degrees
  ➢ Random Affine: randomly shifts the image by up to 10% of its width and height
  ➢ Color Jitter: randomly alters image colors (brightness, contrast, saturation, hue)
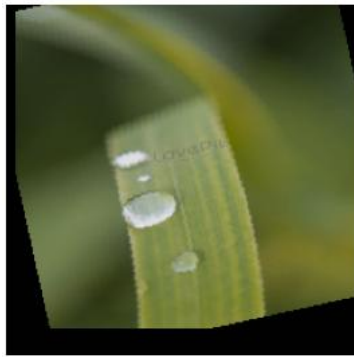
GoogLeNet

- 9 Inception blocks: 2 – 5 – 2 with max pool between them

- Final global average pooling + fully connected layer + SoftMax

- 2 Auxiliary classifiers that help combat the vanishing gradient problem and provide additional regularization

- Batch Normalizaztion instead of Local Response Normalization
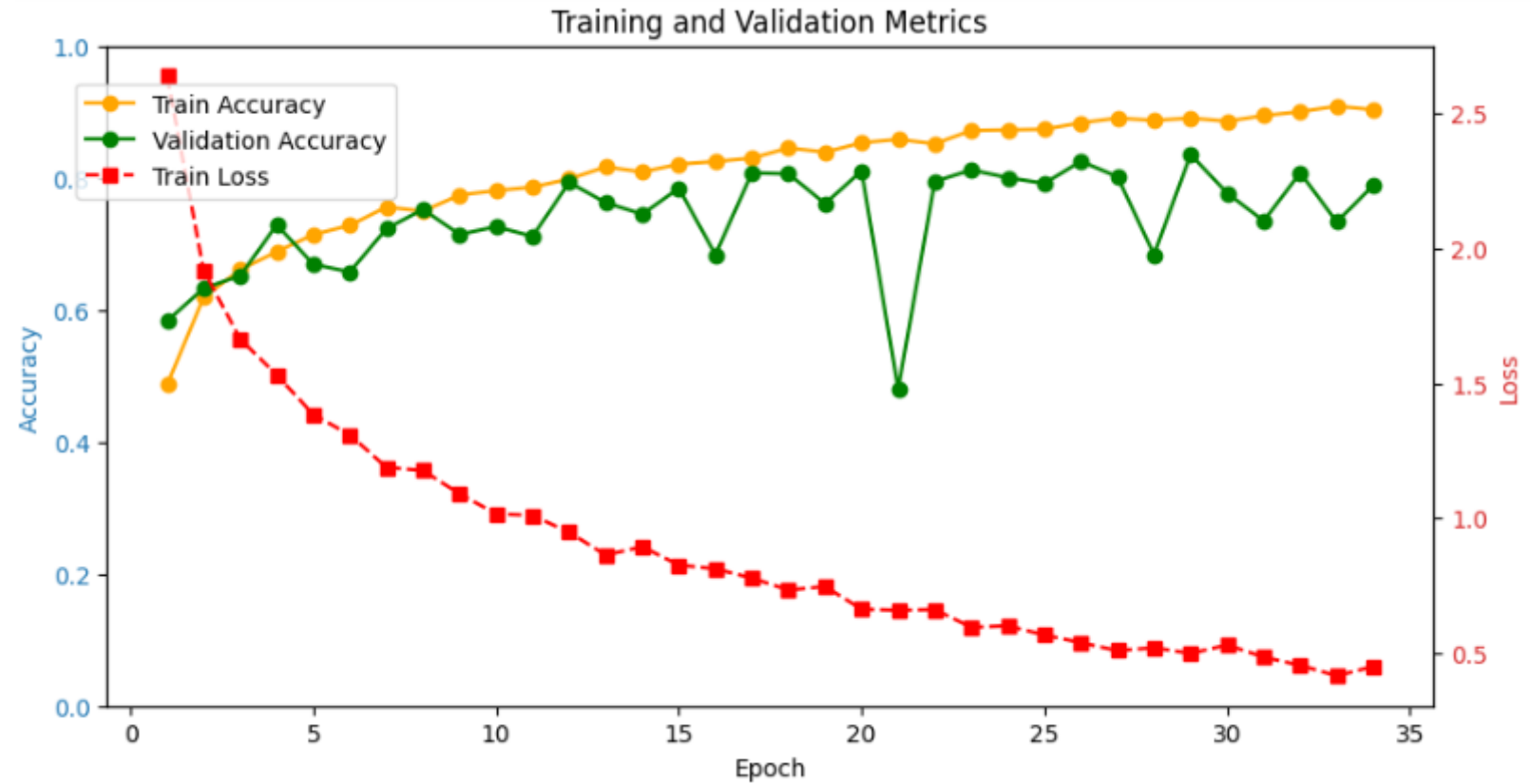
- Activation functions: ReLu
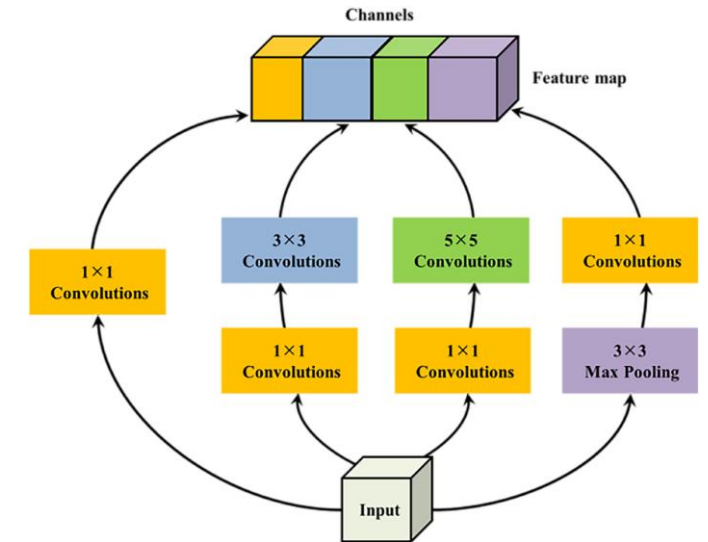
Training

- Inizialization: kaiming normal for weights and biases = 0

- Optimizer: ADAM with Learning Rate = 0.0001, no weight decay

- Max Epochs = 50

- Early stopping: patience of 5 epochs on validation accuracy

- Cross entropy loss with class weights

$$w_c = \frac{N}{|C| \times n_c}$$

- Auxiliary losses weight = 0.3

- Dropout = 0.3

Testing

Classification Report:

		precision	recall	f1-score	support
Dew	0	0.8046	0.9459	0.8696	74
Fog/Smog	1	0.8955	0.7500	0.8163	80
Frost	2	0.6000	0.4186	0.4932	43
Glaze	3	0.4878	0.7843	0.6015	51
Hail	4	0.7821	0.8971	0.8356	68
Lightning	5	0.9250	0.9250	0.9250	40
Rain	6	0.7931	0.8070	0.8000	57
Rainbow	7	0.8125	0.8966	0.8525	29
Rime	8	0.9620	0.6847	0.8000	111
Sandstorm	9	0.7826	0.9600	0.8623	75
Snow	10	0.7857	0.5593	0.6535	59
accuracy				0.7846	687
macro avg		0.7846	0.7844	0.7736	687
weighted avg		0.8044	0.7846	0.7827	687
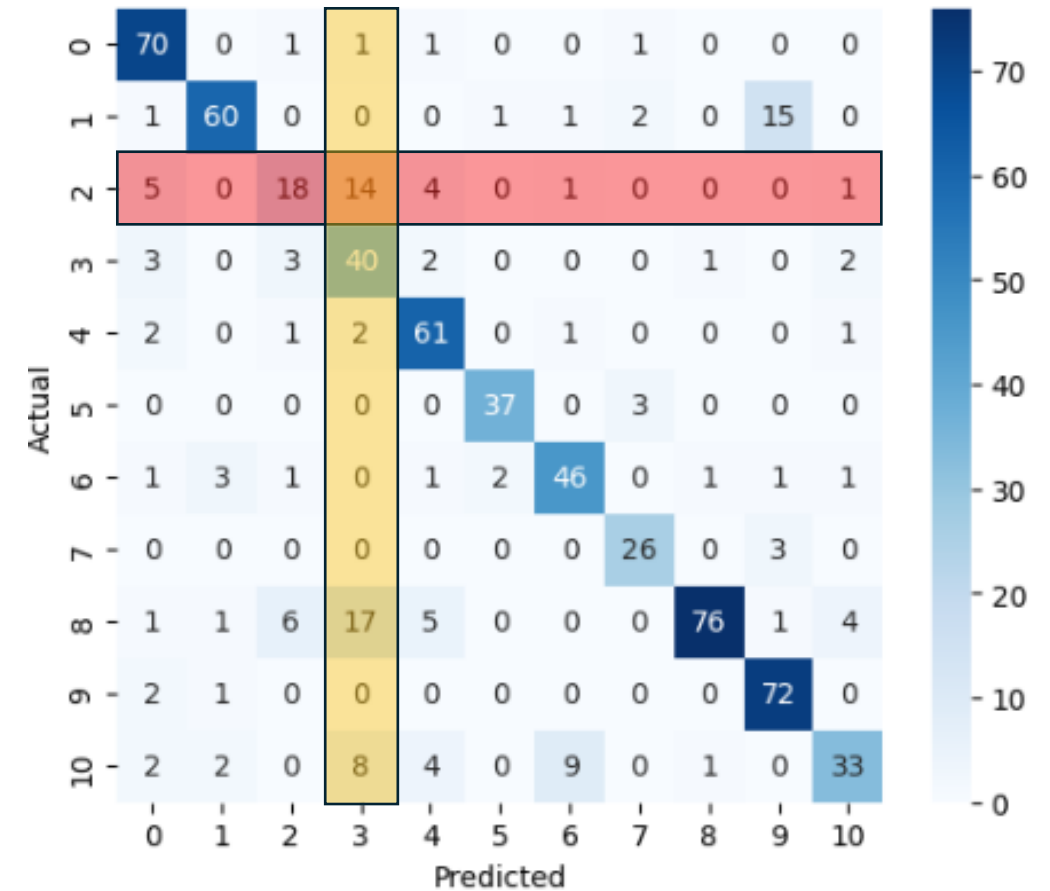
Testing on real images

Predicted: sandstorm

Predicted: rainbow

Predicted: snow

Thank you

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