Group 5 Results

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Outline

- Our Model and its Optimization
  - Model
  - Optimization
- Further
  - Question 1 : How do you measure your network's performance? What is your reason for this choice? What other good choices are there?
  - Question 2 : What makes Class 5 stand out? How can this be addressed?
  - Question 3 : Find the galaxy images that your network performs best(worst) with. Explain why this is the case.

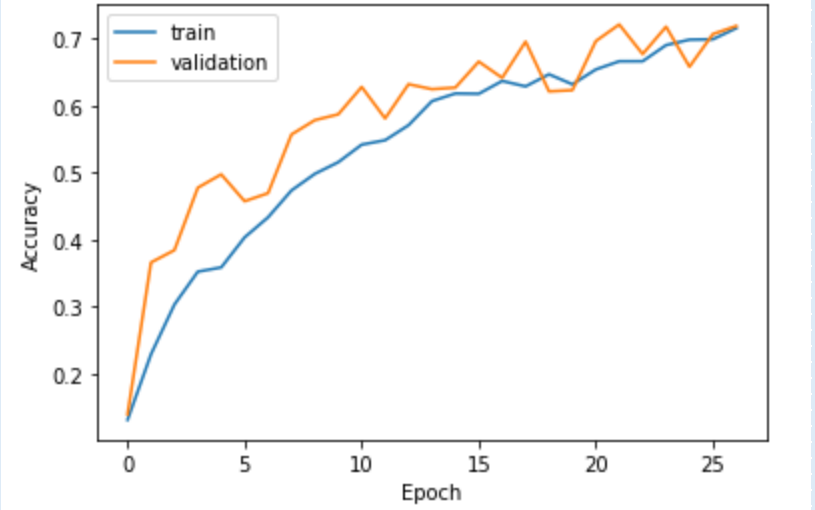
Primary Task: Train a neural network to classify the galaxy image's shapes

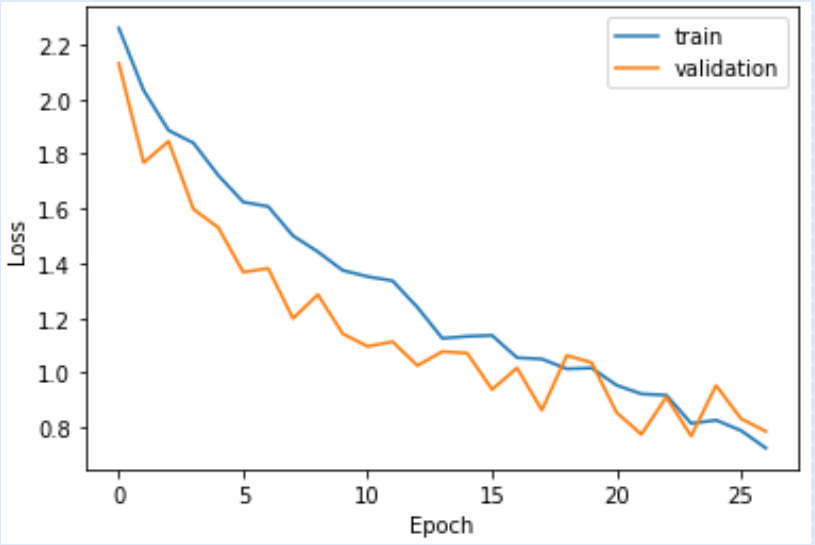
- We use eLU for convolutional layers.
- We use ReLU for dense layers.
- We always have two sequential convolutional layers before pooling.
- We used max pooling.
- Dense layers with many nodes.
- Added a dropout layer with a 0.5 rate.

Layer (type)	Output Shape
input_7 (InputLayer)	[(None, 64, 64, 1)]
conv2d_28 (Conv2D)	(None, 64, 64, 16)
conv2d_29 (Conv2D)	(None, 64, 64, 16)
max_pooling2d_12 (MaxPooling2D)	(None, 32, 32, 16)
conv2d_30 (Conv2D)	(None, 32, 32, 32)
conv2d_31 (Conv2D)	(None, 32, 32, 32)
max_pooling2d_13 (MaxPooling2D)	(None, 16, 16, 32)
conv2d_32 (Conv2D)	(None, 12, 12, 64)
conv2d_33 (Conv2D)	(None, 8, 8, 64)
flatten_6 (Flatten)	(None, 4096)
dense_19 (Dense)	(None, 200)
dense_20 (Dense)	(None, 200)
dense_21 (Dense)	(None, 100)
dropout_8 (Dropout)	(None, 100)
dense_22 (Dense)	(None, 10)

Primary Task: Optimize the model

- Reduced the learning rate to 0.0002.
- Increased the batch size.
- Implemented early stopping to prevent overtraining.
- No regularization.
- Added weights.





Question 1: How do you measure your network's performance? What is your reason for this choice? What other good choices are there?

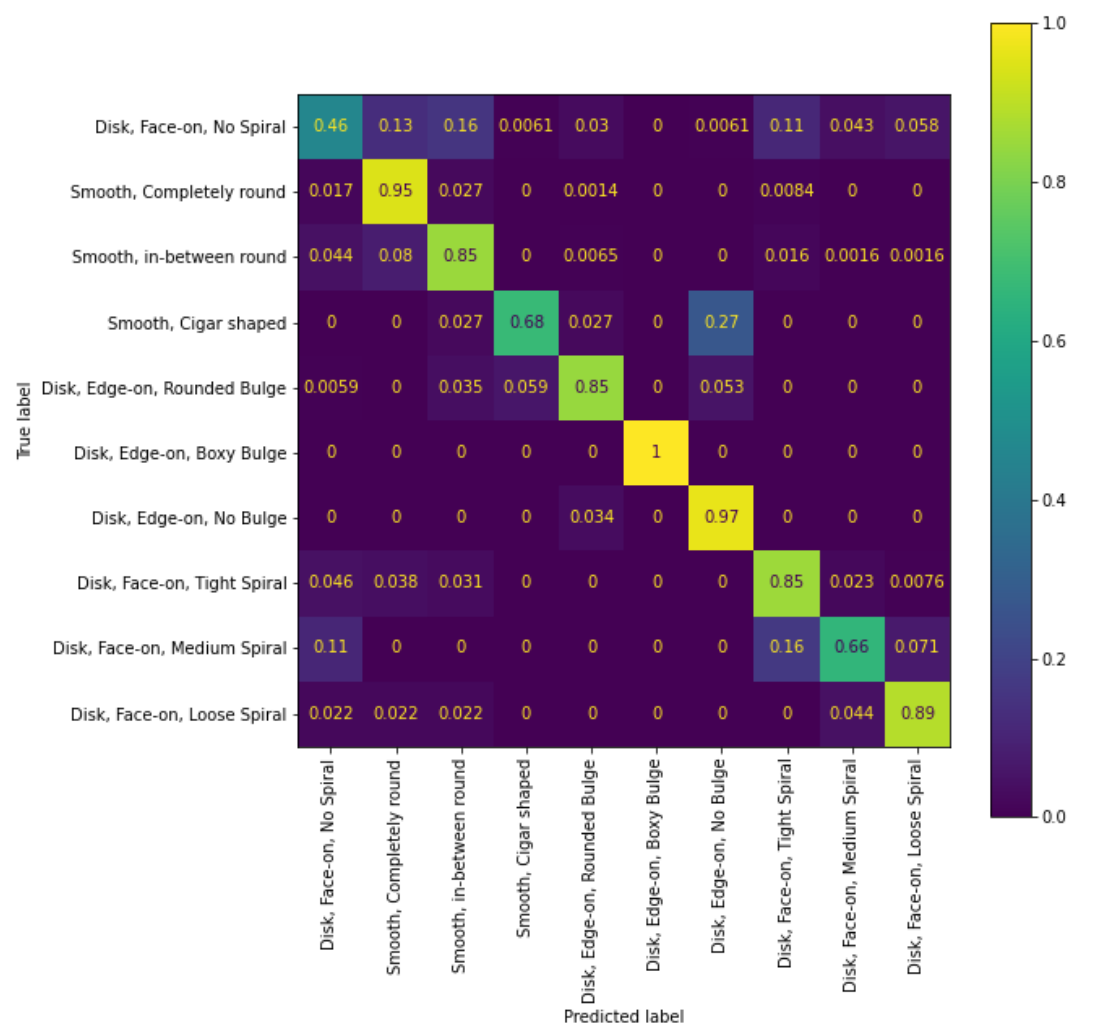
- We can see how good the network is performing by looking at the confusion matrix, which ideally would be diagonal.
  - The closer to that form, the better.

Question 2: What makes Class 5 stand out? How can this be addressed?

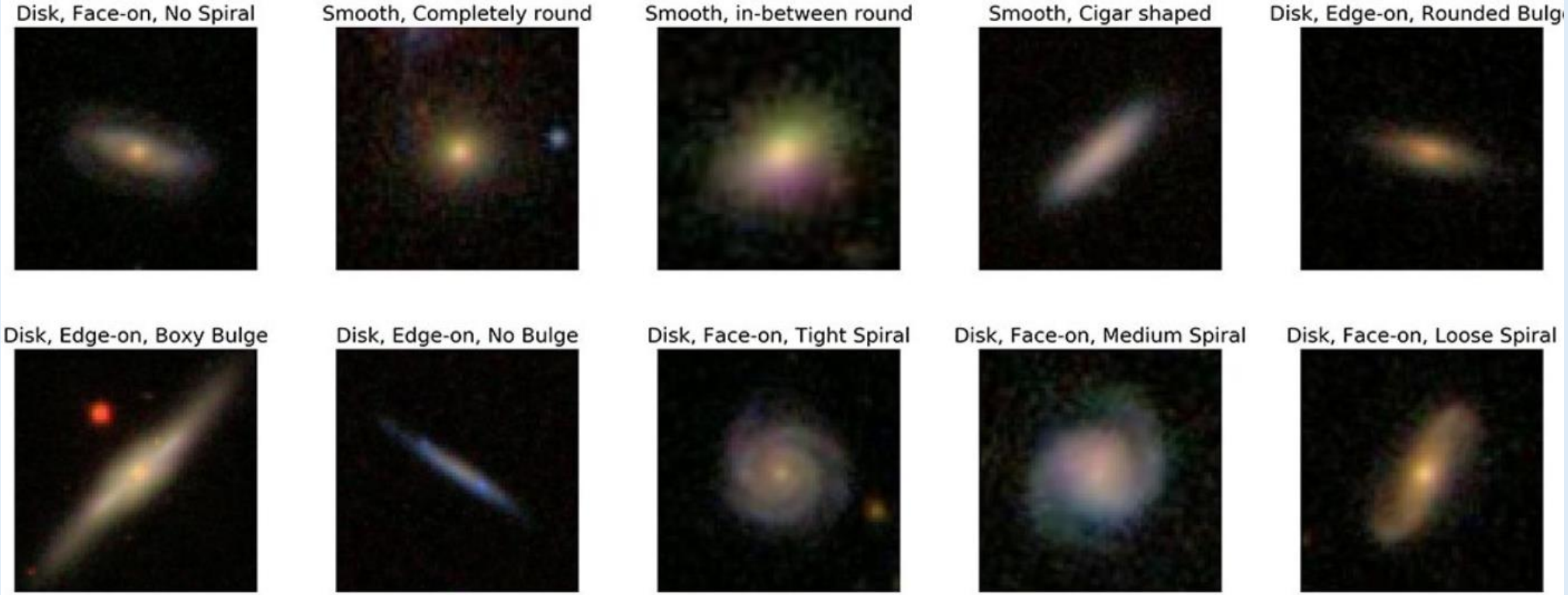
- Class 5 has way too few samples compared to other ones by an order of magnitude of 3.
- We can address it by oversampling the class by mirroring, rotating or modifying weights.

Question 3: Find the galaxy images that your network performs best(worst) with. Explain why this is the case.

- Best class performance: Disk, Edge-on, No Bulge (class 6)
- 2nd best: Smooth, completely round (class 1)
  - Both are comparably more distinctive than other classes.
- Worst class performance: Disk, Face-on, no spiral (class 0)
  - Class 0 gets categorized into 1 and 2
- Bad performance also with:
  - Class 8 gets mixed up with 7
  - Class 3 gets mixed up with 6



Example images of each class from Galaxy10 dataset



Galaxy10 Dataset: Henry Leung/Jo Bovy 2018, Data Source: SDSS/Galaxy Zoo

Thanks!