Who is this Pokemon?

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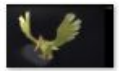
Dataset - Pokemon Generation ONE

- +10.000 images
- 149 classes
- ~60 images for each pokemon
- 1.2 GB

Dataset - Problems

- Duplicate images (Fearow 124 > 63)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f2940a98c
82a2e9ca1
2e3ef


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a0f07e2f37
0a277


4fd4b90c1
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a9c41054f
33b2d


12492af1f8
d749ffbb4f
d856c9540
5b3


d61d33ad
678741e2a
ab071bf78
dc0003


e1a2a27d5
beb4da192
4740b216e
805fd

Dataset - Problems

- Wrong / Missing labelled images

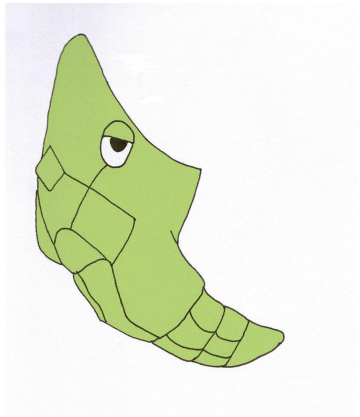
True: Mankey
Pred: Raticate 99.96%

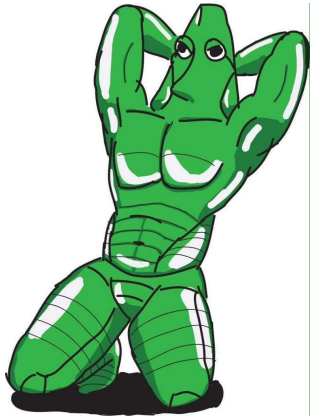
True: Nidoqueen
Pred: Nidoking 76.87%

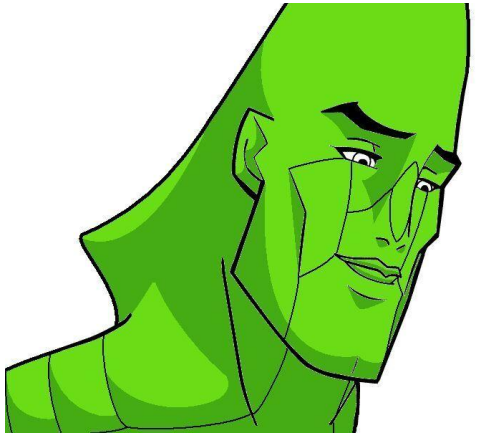
True: Squirtle
Pred: Bulbasaur 49.24%

Dataset - Problems

- Lots of weird images







Preprocessing - Building the dataset (1/2)

- Test size 10%
- Size of the classes - 35 ~ 300

Preprocessing - Building the dataset (2/2)

- Data augmentation
  - Random Contrast
  - Random Translation
  - Random Flip
  - Random Rotation
- Up to 200 images for each class
- Test size 20%

Preprocessing - Building the dataset (2/2)

- Cleaning opt.
  - Removing duplicates
  - Removing unsupported extensions (.gif , .svg , ...)
  - In total, +600 images

Base Model

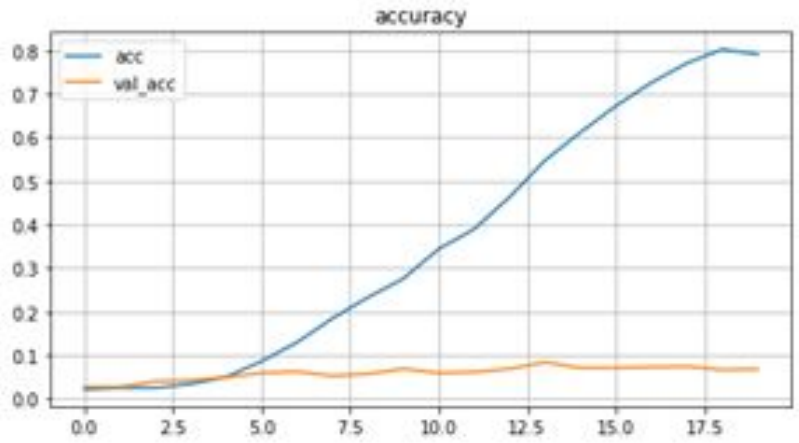
- Google CNN

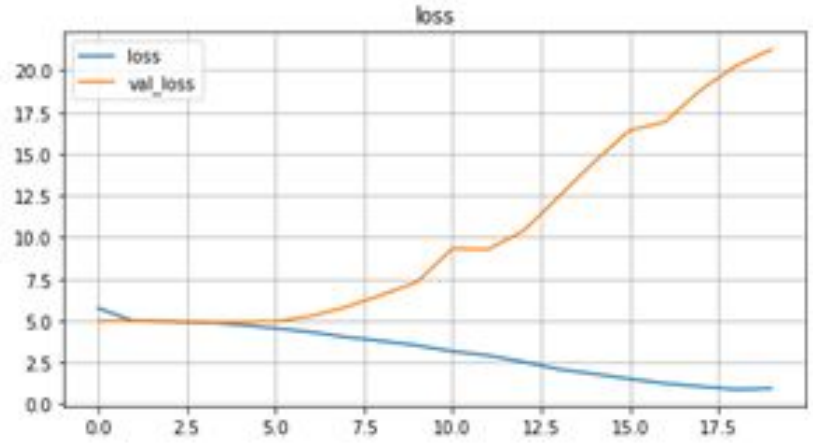
```
model = models.Sequential()
model.add(layers.Conv2D(32, (3, 3), activation='relu', input_shape=(32, 32, 3)))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
```

```
model.add(layers.Flatten())
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(10))
```

Experiments - 1

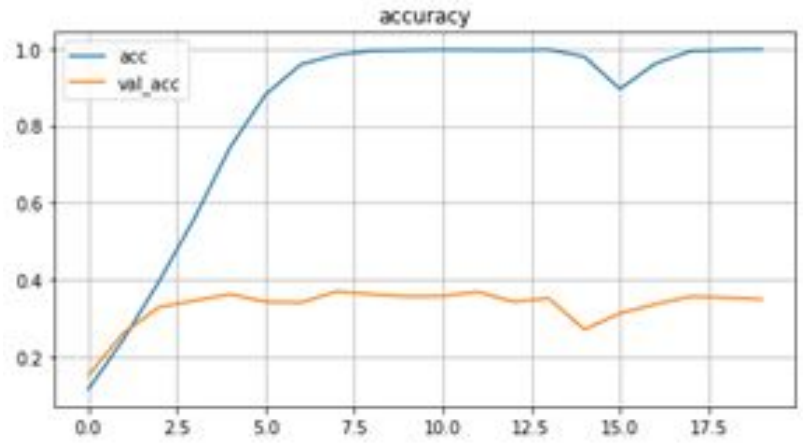
- Google CNN
- 20 Epochs - 96x96 Res. - 0.93 Training Acc. - 0.08 Validation Acc.

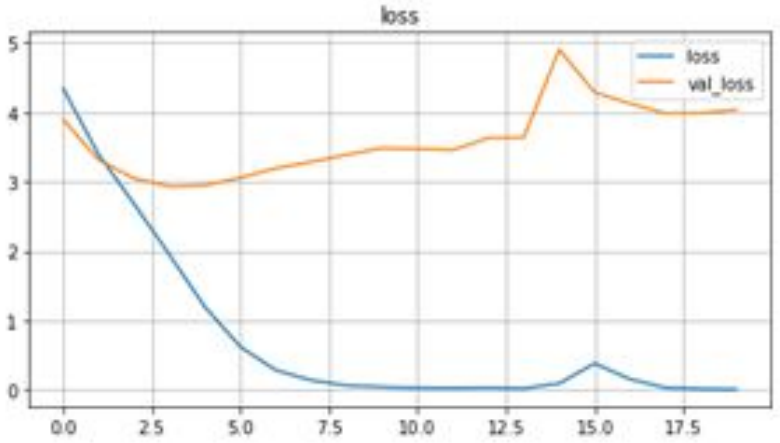




Experiments - 2

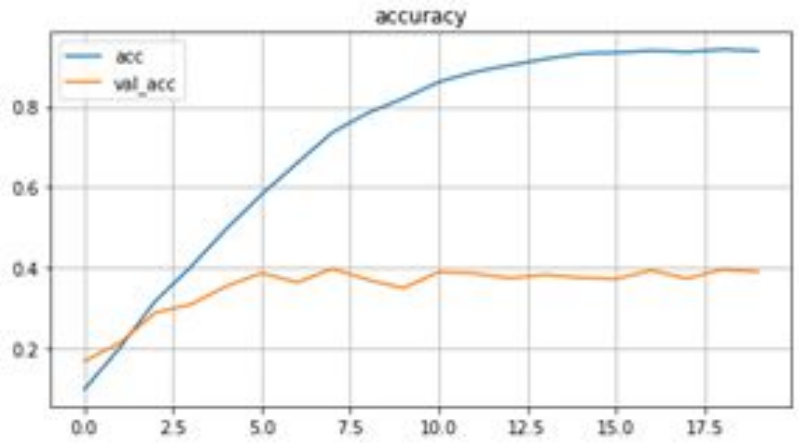
- Google CNN + Batch normalization
- 20 Epochs - 96x96 Res. - 0.99 Training Acc. - 0.36 Validation Acc.

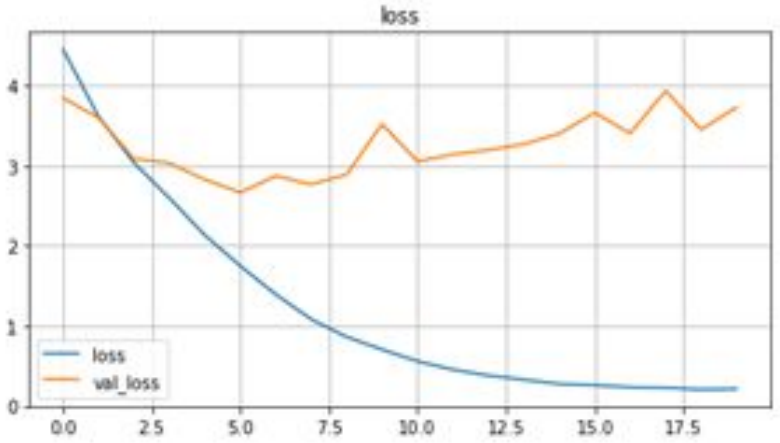




Experiments - 3

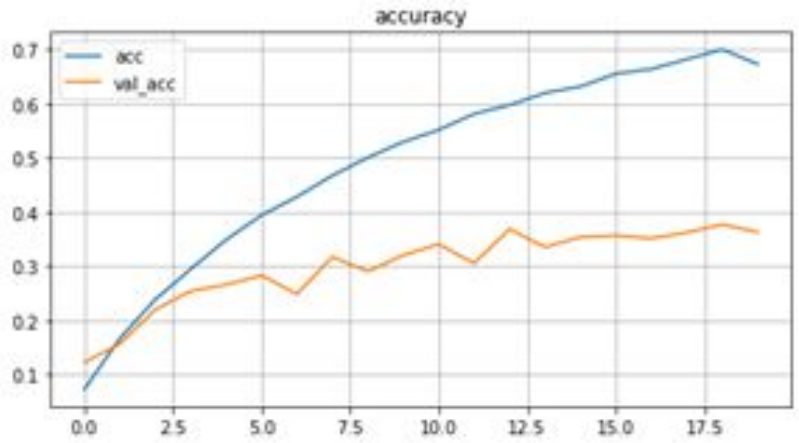
- Google CNN + Hidden layers with dropout 0.25
- 20 Epochs - 96x96 Res. - 0.93 Training Acc. - 0.39 Validation Acc.

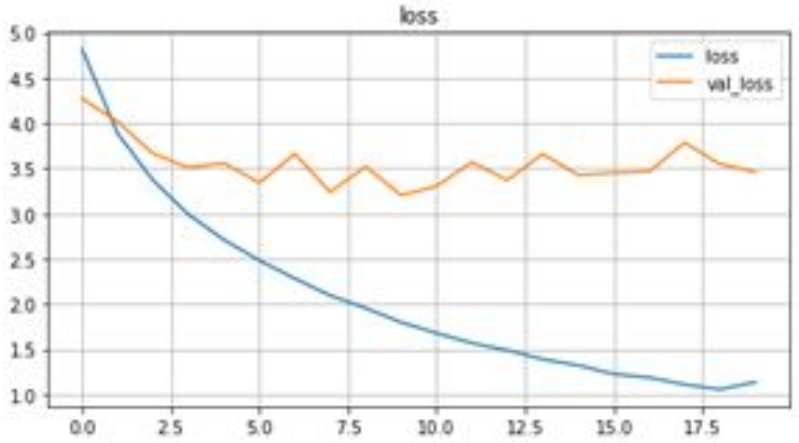




Experiments - 4

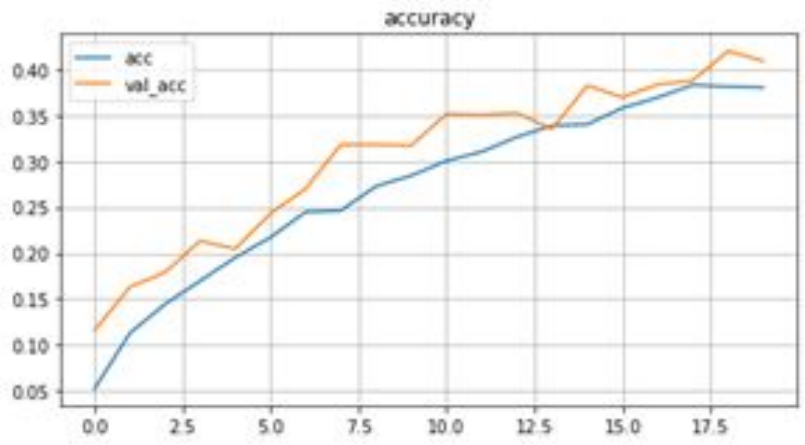
- Google CNN + Hidden layers with dropout 0.5
- 20 Epochs - 96x96 Res. - 0.67 Training Acc. - 0.37 Validation Acc.

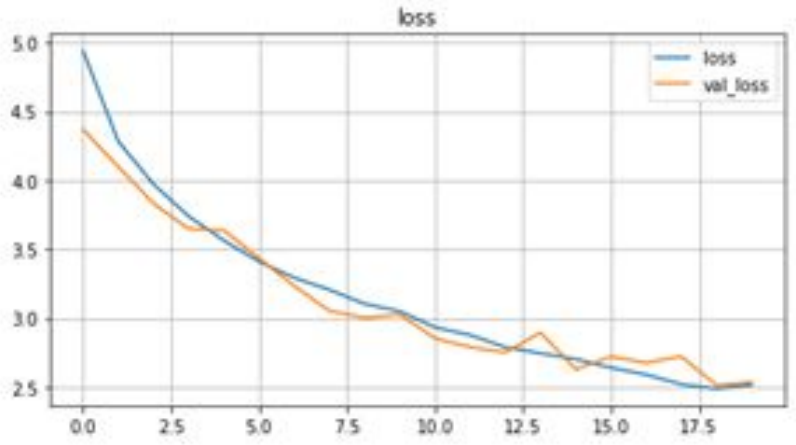




Experiments - 5

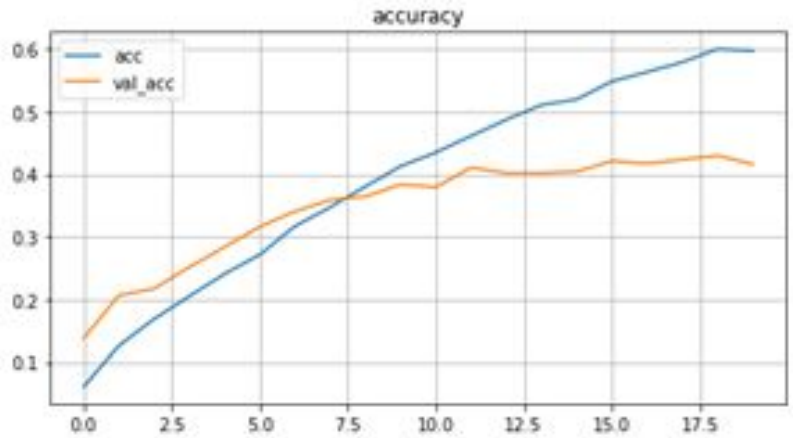
- Google CNN + Hidden layers and Output layers with dropout 0.5
- 20 Epochs - 96x96 Res. - 0.38 Training Acc. - 0.42 Validation Acc.

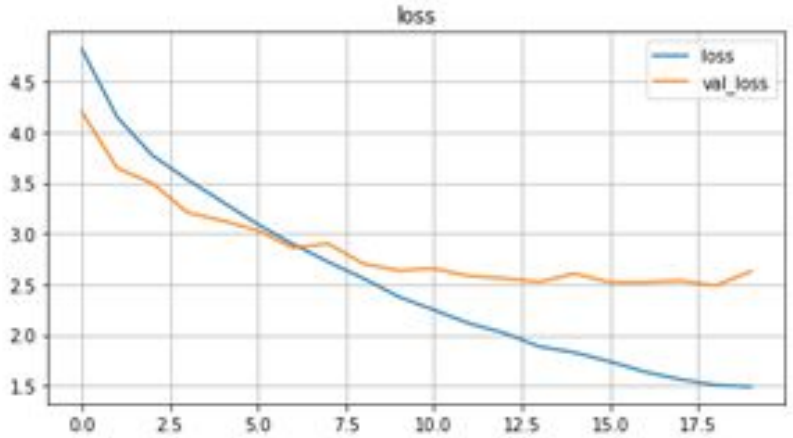




Experiments - 6

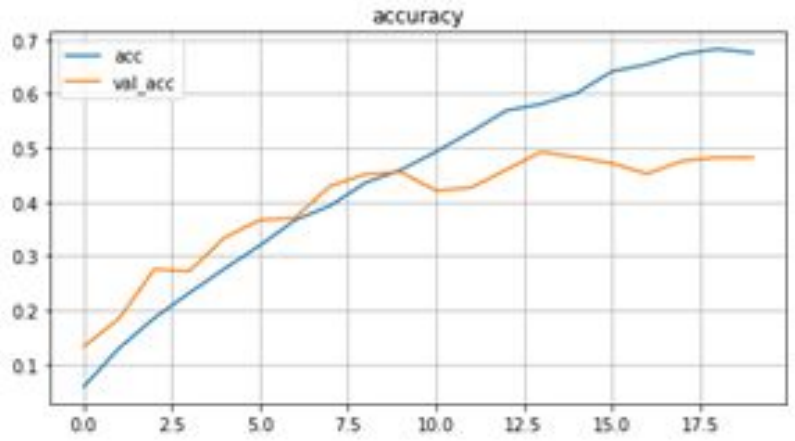
- Google CNN + Hidden w/ dropout 0.25 - Output w/ dropout 0.5
- 20 Epochs - 96x96 Res. - 0.59 Training Acc. - 0.43 Validation Acc.

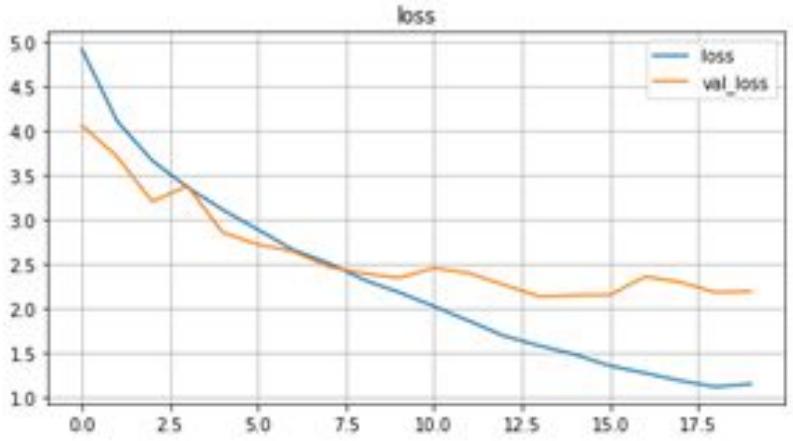




Experiments - 7

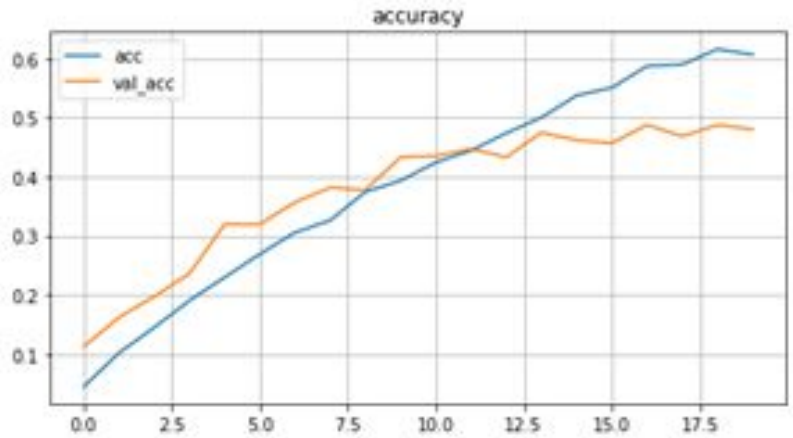
- Google CNN + New layer and Neuron count (32, 64, 128, 256)
- 20 Epochs - 96x96 Res. - 0.67 Training Acc. - 0.49 Validation Acc.

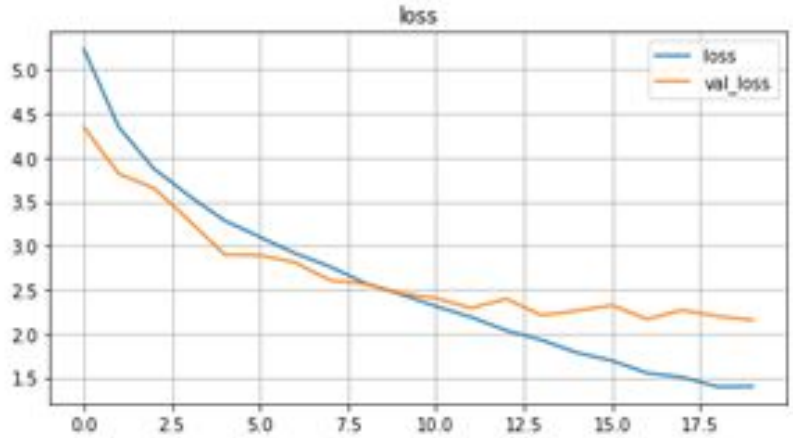




Experiments - 8

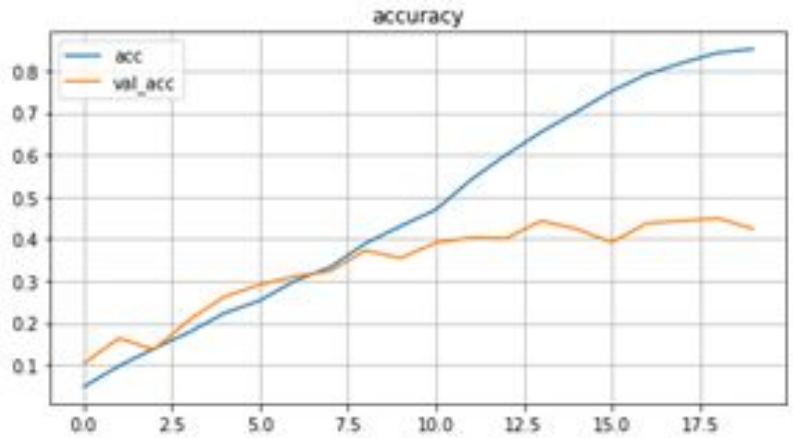
- Google CNN + New output layers (512, 256)
- 20 Epochs - 96x96 Res. - 0.60 Training Acc. - 0.48 Validation Acc.

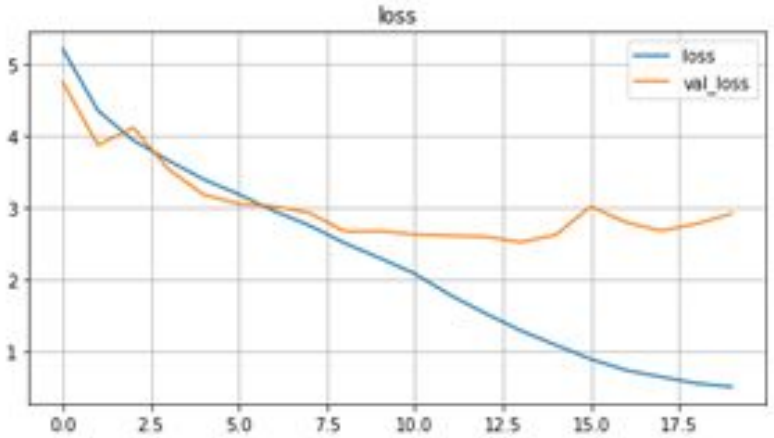




Experiments - 9

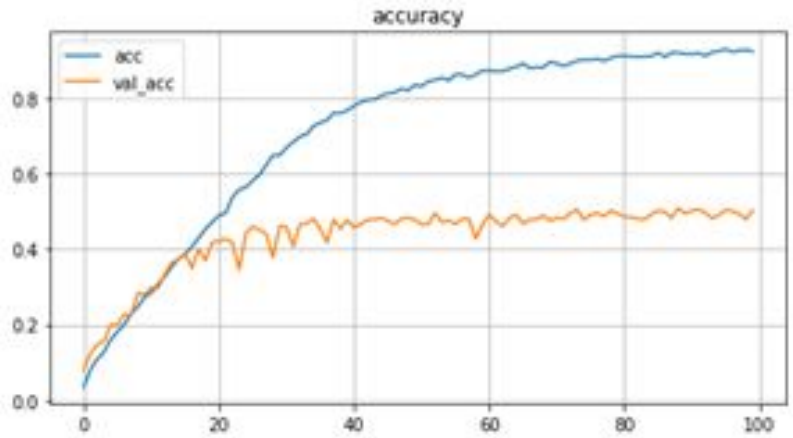
- Google CNN - Testing on high resolution (96 -> 256)
- 20 Epochs - 256x256 Res. - 0.85 Training Acc. - 0.45 Validation Acc.

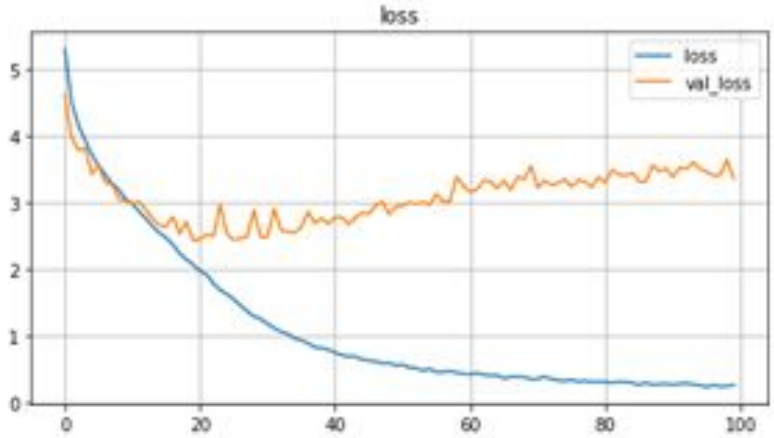




Experiments - 10

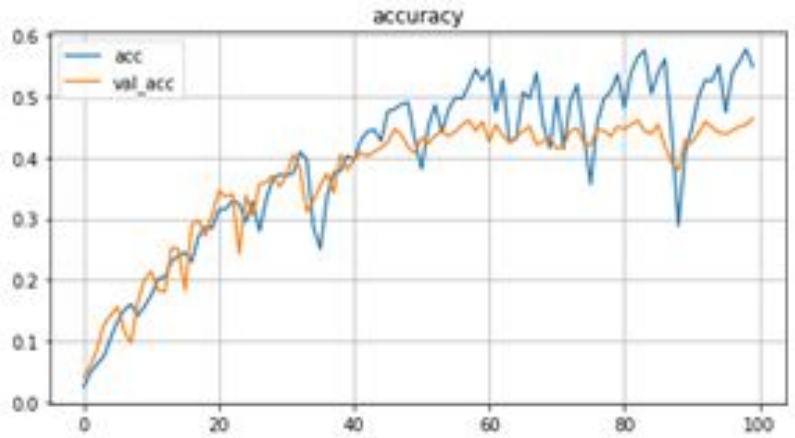
- Google CNN + Increased number of Epochs (20 -> 100)
- 100 Epochs - 96x96 Res. - 0.92 Training Acc. - 0.51 Validation Acc.

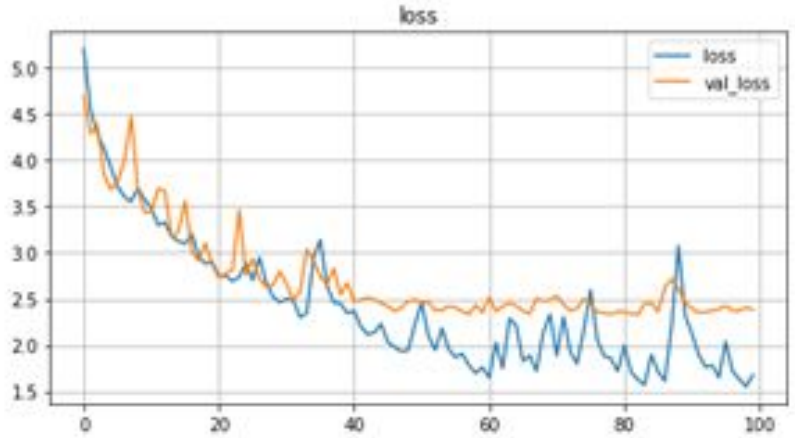




Experiments - 11 - Data Augmentation

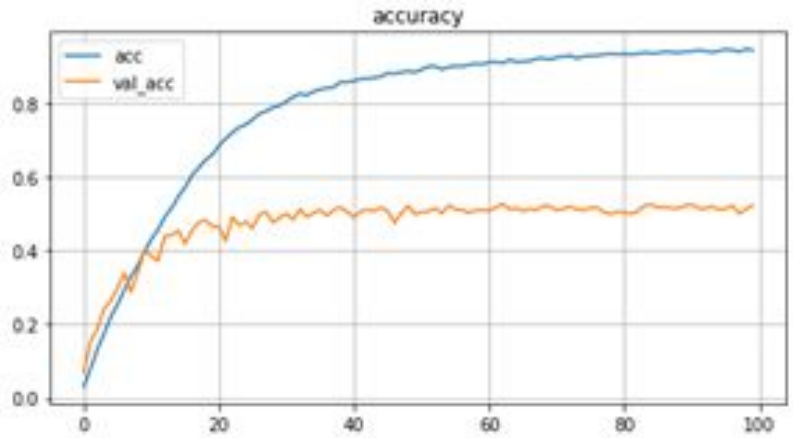
- Google CNN + each class has 100 train images but same test size
- 100 Epochs - 96x96 Res. - 0.54 Training Acc. - 0.46 Validation Acc.

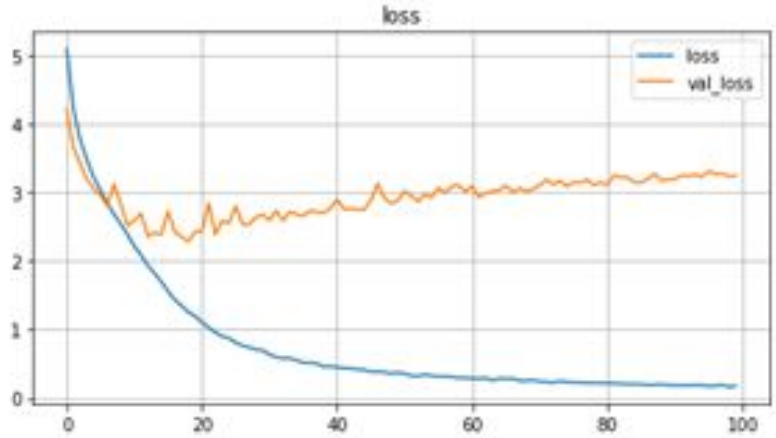




Experiments - 12 - Data Augmentation

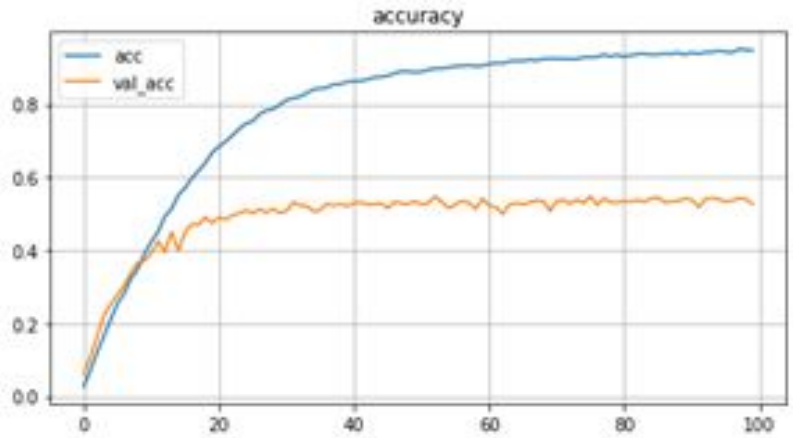
- Google CNN + 100 train images and 20 test images
- 100 Epochs - 96x96 Res. - 0.94 Training Acc. - 0.52 Validation Acc.

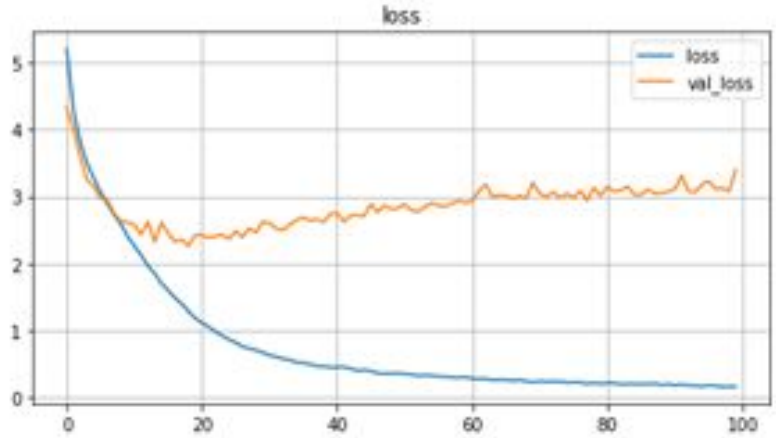




Experiments - 13 - Data Augmentation

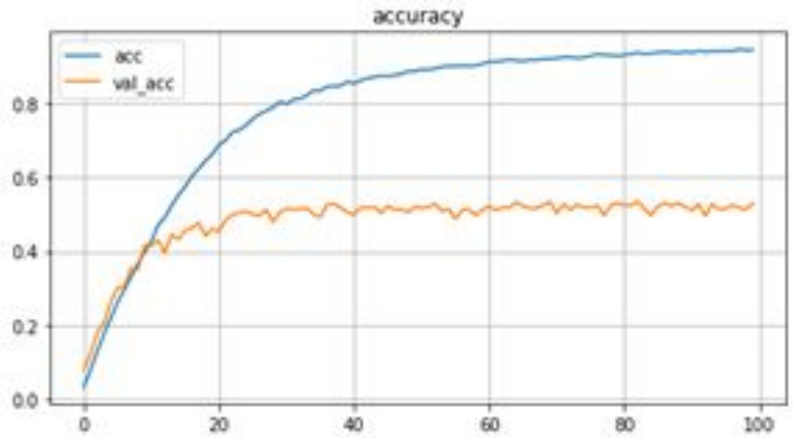
- Google CNN + Removed all duplicate and their original images
- 100 Epochs - 96x96 Res. - 0.94 Training Acc. - 0.54 Validation Acc.

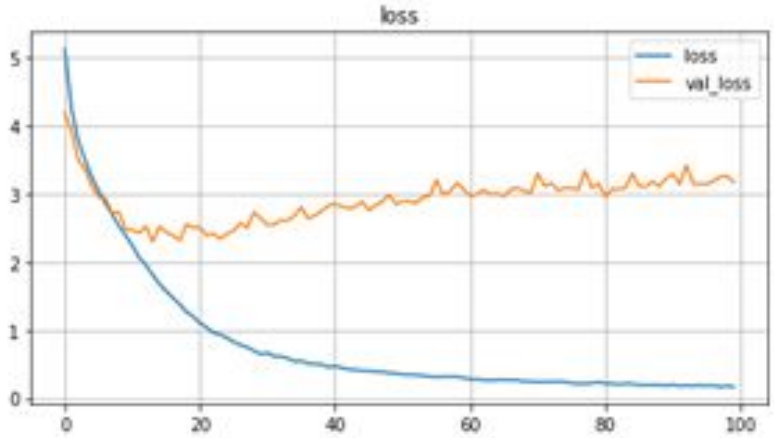




Experiments - 15 - Data Augmentation

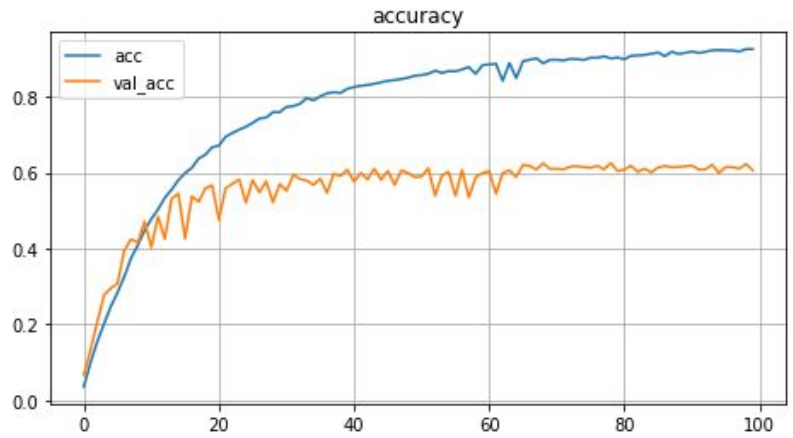
- Google CNN + Removed all duplicate in the same class
- 100 Epochs - 96x96 Res. - 0.94 Training Acc. - 0.53 Validation Acc.

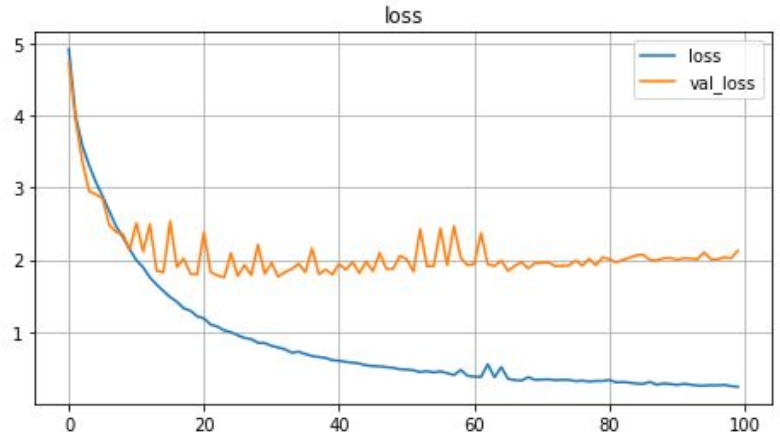




Experiments - 16 - Best Model

- Modified Google CNN + 200 images per class
- 100 Epochs - 96x96 Res. - 0.92 Training Acc. - 0.63 Validation Acc.





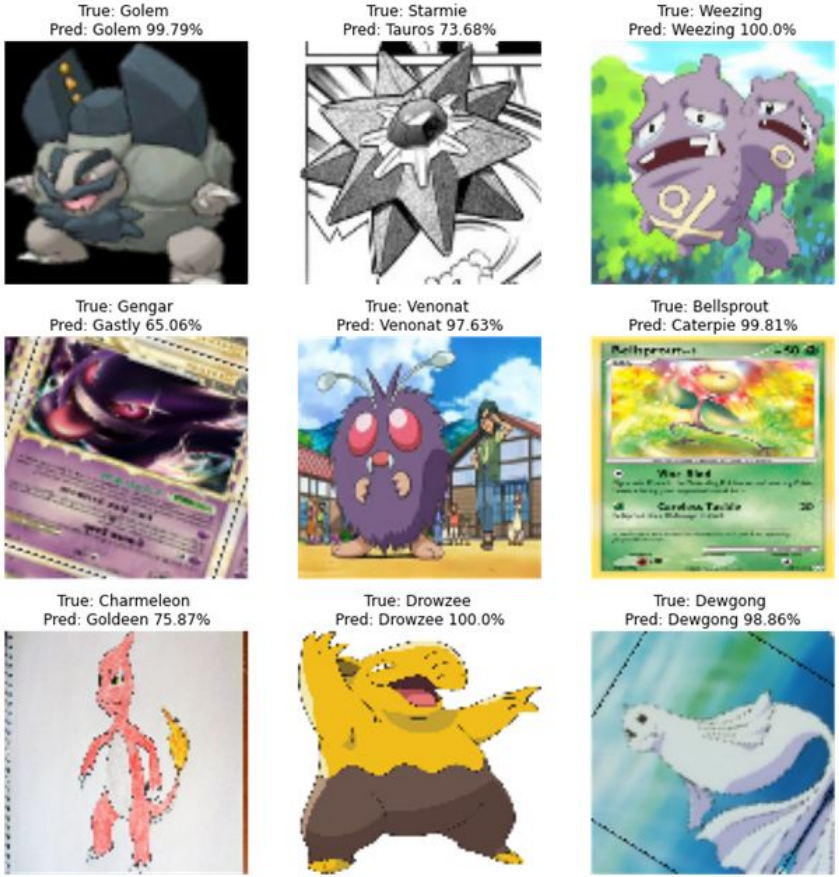
Experiments - Transfer Learning

Model	Epochs	Train Acc.	Test Acc.
Vgg16 - Flatten	20	0.9986	0.4231
Vgg16 + 256 Dense	20	0.6119	0.3979
Vgg16 + 512 Dense	20	0.4807	0.3977
Resnet - Flatten	20	0.9555	0.5391
Resnet + 256 Dense	20	0.9491	0.4262
Resnet + 512 Dense	20	0.8656	0.3957

Results


True: Koffing
Pred: Ditto 99.74%
True: Vileplume
Pred: Vileplume 99.96%
True: Drowzee
Pred: Drowzee 100.0%
True: Porygon
Pred: Porygon 97.52%
True: Dratini
Pred: Dratini 100.0%
True: Seadra
Pred: Seadra 99.23%
True: Zapdos
Pred: Zapdos 100.0%
True: Growlithe
Pred: Clefairy 49.43%
True: Pikachu
Pred: Pikachu 100.0%

Results


True: Golem
Pred: Golem 99.79%
True: Starmie
Pred: Tauros 73.68%
True: Weezing
Pred: Weezing 100.0%
True: Gengar
Pred: Gastly 65.06%
True: Venonat
Pred: Venonat 97.63%
True: Bellsprout
Pred: Caterpie 99.81%
True: Charmeleon
Pred: Goldeen 75.87%
True: Drowzee
Pred: Drowzee 100.0%
True: Dewgong
Pred: Dewgong 98.86%

Conclusion

- Classification with +100 classes is not an easy problem
- Need more images and a well prepared dataset
- Computational limitations