CNN design and transfer learning

Final project

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July 10, 2023

The dataset: CIFAR-10

Figure: 2 pictures form CIFAR-10, 1 Picture (32,32,3)

CNNs with 'arbitrary' network structure

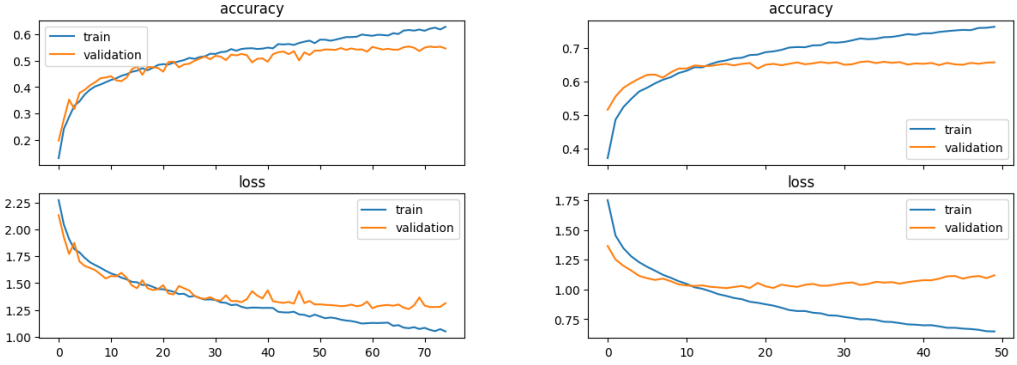

Figure: Both show very different quality for the problem

One CNN structure for 3 Tasks

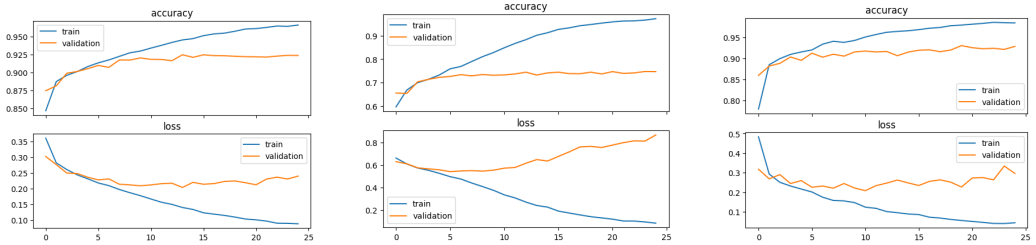

Figure: 1. Cats vs Dogs, 2. Cats vs Dogs, 3. Animals vs Machines

The structure seems suitable for some tasks

MetaQNN: How to find a really well fitting network structure

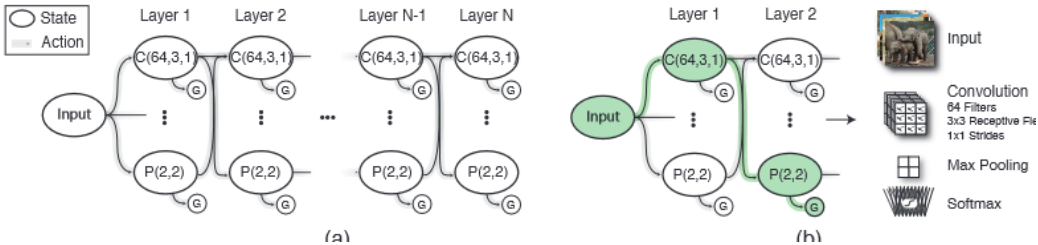

Figure: State space von QNN[1]

Idea: Utilizing reinforcement learning to obtain a well performing network structure. The agent might choose from predefined layers

[1]Baker et al., 2017,DESIGNING NEURAL NETWORK ARCHITECTURES USING REINFORCEMENT LEARNING

Problems

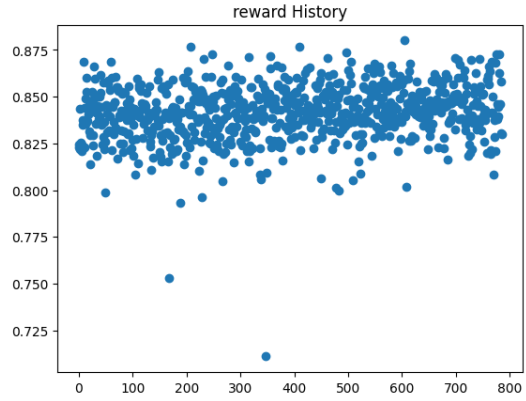

Figure: Our reward history after some hours

Huge state space, many CNNs so high computational effort

Further approaches

1. epsilon-decay

2. epochs increase over time

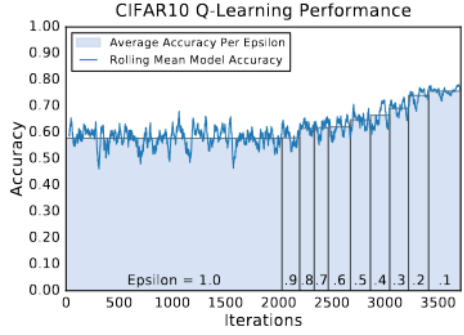

Figure: [a]

[a] Baker et al., 2017

Transfer learning

- We want to use an already trained CNN for a similar task
- CIFAR100: 100 classes and 20 superclasses
- Freeze early layers of trained CNN
- Only train a few additional layers
- Decent classification in little time

Transfer from CIFAR-10 to CIFAR-100

Left side:Pretrained CNN on CIFAR-10: Accuracy 82%

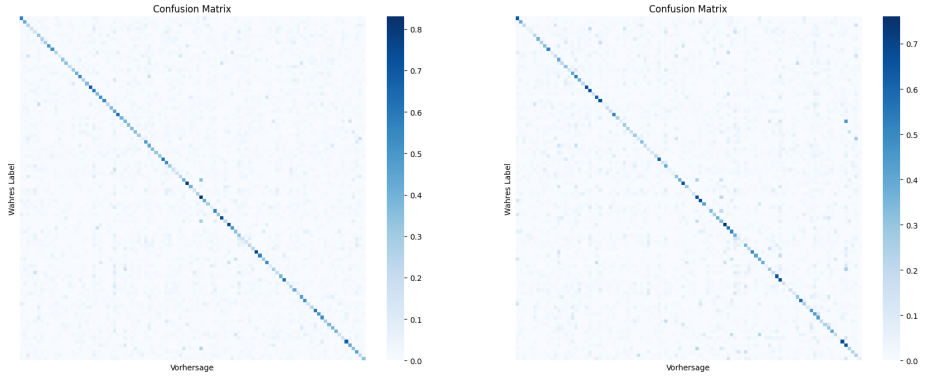

Figure: Accuracy: 0.58 vs 0.51, in 1/5 of the time

observations

- classes the CNN was trained on effects the result
- helps when there is little data (classes in CIFAR100)
- Very good 2 class classification on CIFAR100
- poorly trained CNN will result in a very bad transfer learning

pre learnde vgg16-model

- vgg16 is a 16-layer CNN
- trained on 1000 classes with over 1.000.000 pictures
- >0.8 validation accuracy in first epoch, >0.9 after 10 epochs

Layer (type)	Output Shape	Param #
input_1 (InputLayer)	[(None, 48, 48, 3)]	0
block1_conv1 (Conv2D)	(None, 48, 48, 64)	1792
block1_conv2 (Conv2D)	(None, 48, 48, 64)	36928
block1_pool (MaxPooling2D)	(None, 24, 24, 64)	0
block2_conv1 (Conv2D)	(None, 24, 24, 128)	73856
block2_conv2 (Conv2D)	(None, 24, 24, 128)	147584
block2_pool (MaxPooling2D)	(None, 12, 12, 128)	0
block3_conv1 (Conv2D)	(None, 12, 12, 256)	295168
block3_conv2 (Conv2D)	(None, 12, 12, 256)	590080
block3_conv3 (Conv2D)	(None, 12, 12, 256)	590080
block3_pool (MaxPooling2D)	(None, 6, 6, 256)	0

...

Total params: 1,869,642