DEEP FRUITS
FRUIT RECOGNITION

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DATASET

Training set size: ca. 29'000 (75%)

Validation set size: ca. 9'800 (25%)

Testdata: scattered pictures

Number of classes: 60

Pictures per class on Training set: ca. 500

Distribution of classes: nearly evenly

Speciality: pictures shoots in 360°

METHODOLOGY & RESULTS VAL

Fully Connected
- ca. 900'000 Parameters
- Acc Validation: 53%

CNN Simple
- ca. 230'000 Parameters
- Acc Val: 98%

CNN Advanced (inkl. Data-Augmentation)
- ca. 1'850'000 Parameters
- Acc Val: 99%

CNN RESULTS VAL VS TEST

ACC VAL

IMAGE IS OF CLASS: 36: '==MANDARINE==' WITH PROPABILITY OF ==0.999990701675415==
IMAGE IS OF CLASS: 59: 'TANGELO' WITH PROPABILITY OF 7.909765372460242E-06
IMAGE IS OF CLASS: 28: 'HUCKLEBERRY' WITH PROPABILITY OF 1.0021070693255751E-06
IMAGE IS OF CLASS: 45: 'PEAR' WITH PROPABILITY OF 1.765872639225563E-07
IMAGE IS OF CLASS: 54: 'QUINCE' WITH PROPABILITY OF 1.1250386933170375E-07

ACC TEST

IMAGE IS OF CLASS: 46: 'PEAR ABATE' WITH PROPABILITY OF 0.7861698269844055
IMAGE IS OF CLASS: 13: '==BANANA==' WITH PROPABILITY OF ==0.09==081044048070908
IMAGE IS OF CLASS: 18: 'CLEMENTINE' WITH PROPABILITY OF 0.07657881081104279
IMAGE IS OF CLASS: 49: 'PEPINO' WITH PROPABILITY OF 0.010929876007139683
IMAGE IS OF CLASS: 25: 'GRAPEFRUIT PINK' WITH PROPABILITY OF 0.00678615178912878

Deep Fruits – Fruits Recognition

A high-quality, dataset of images containing fruits. The following fruits are included: Apples - (different varieties: Golden, Golden-Red, Granny Smith, Red, Red Delicious), Apricot, Avocado, Avocado ripe, Banana (Yellow, Red), Cactus fruit, Carambula, Cherry, Clementine, Cocos, Dates, Granadilla, Grape (Pink, White, White2), Grapefruit (Pink, White), Guava, Huckleberry, Kiwi, Kaki, Kumsquats, Lemon (normal, Meyer), Lime, Litchi, Mandarine, Mango, Maracuja, Nectarine, Orange, Papaya, Passion fruit, Peach, Pepino, Pear (different varieties, Abate, Monster, Williams), Pineapple, Pitahaya Red, Plum, Pomegranate, Quince, Raspberry, Salak, Strawberry, Tamarillo, Tangelo.

Content

Fruits were planted in the shaft of a low speed motor (3 rpm) and a short movie of 20 seconds was recorded.

A Logitech C920 camera was used for filming the fruits. Behind the fruits a white sheet of paper as background where placed. All marked pixels are considered as being background (which is then filled with white) and the rest of pixels are considered as belonging to the object.

The maximum value for the distance between 2 neighbor pixels is a parameter of the algorithm and is set (by trial and error) for each movie.

DATASET

| DataSet	
Training set size	28'736 (75%)
Validation set size	9'763 (25%)
Number of classes (fruits)	60
Pictures per class (Training set)	ca. 500
Pictures per class (Validation set)	ca. 160
Distribution of classes	nearly evenly
Image size	100x100 pixels
Data size	176 MB
Source	Kaggle

Training vs Validation data distribution

Labels on Training Data   Labels on Validation Data
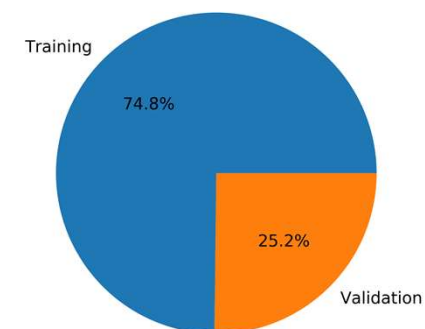
FULLY CONNECTED
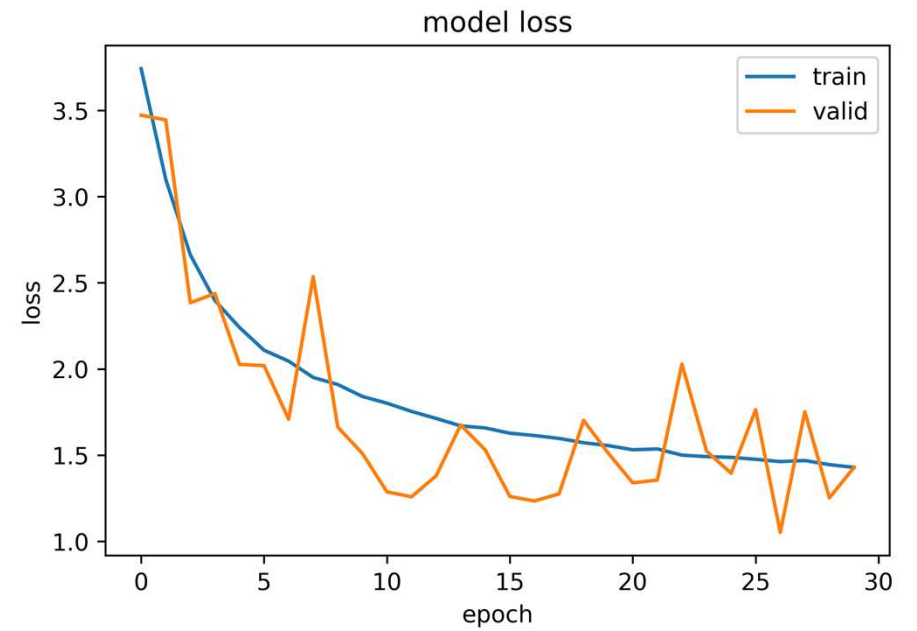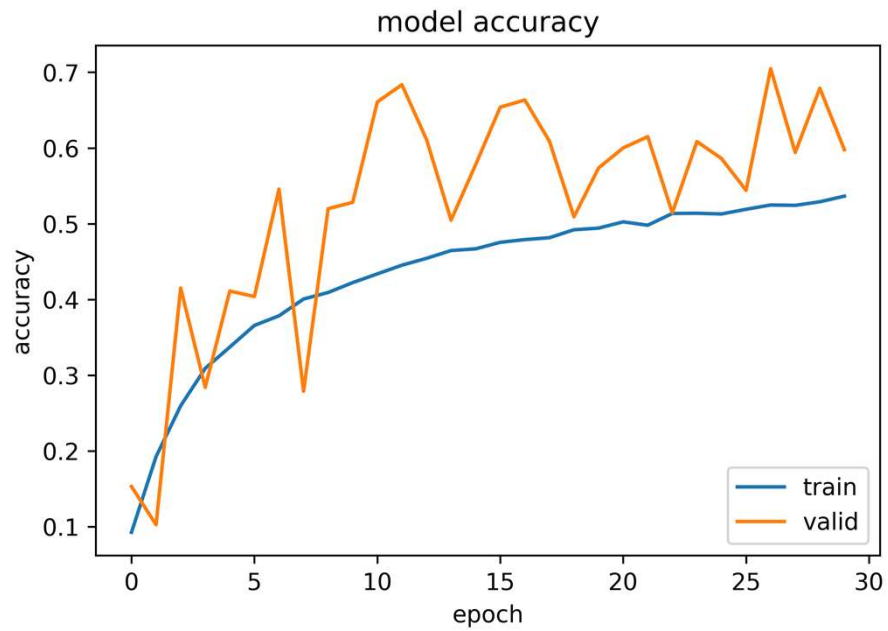
FC

Number of Parameters	901'760
Trainable Parameters	901'640
Non-trainable Parameters	120
Batch-size	128
Number of CNN-Layers	None
Number of Dense-Layers	3 (30, 20, 10 neurons)
Dropout	0.2, 0.3, 0.3
Max-Pooling	Not Applied
Decay	Not Applied
Data Normalization	Not Applied
Data Augmentation	Not Applied
Number of Epochs	30
Activation Formula	ReLU
Loss Function	categorical_crossentropy
Optimizer	adam

CNN SIMPLE
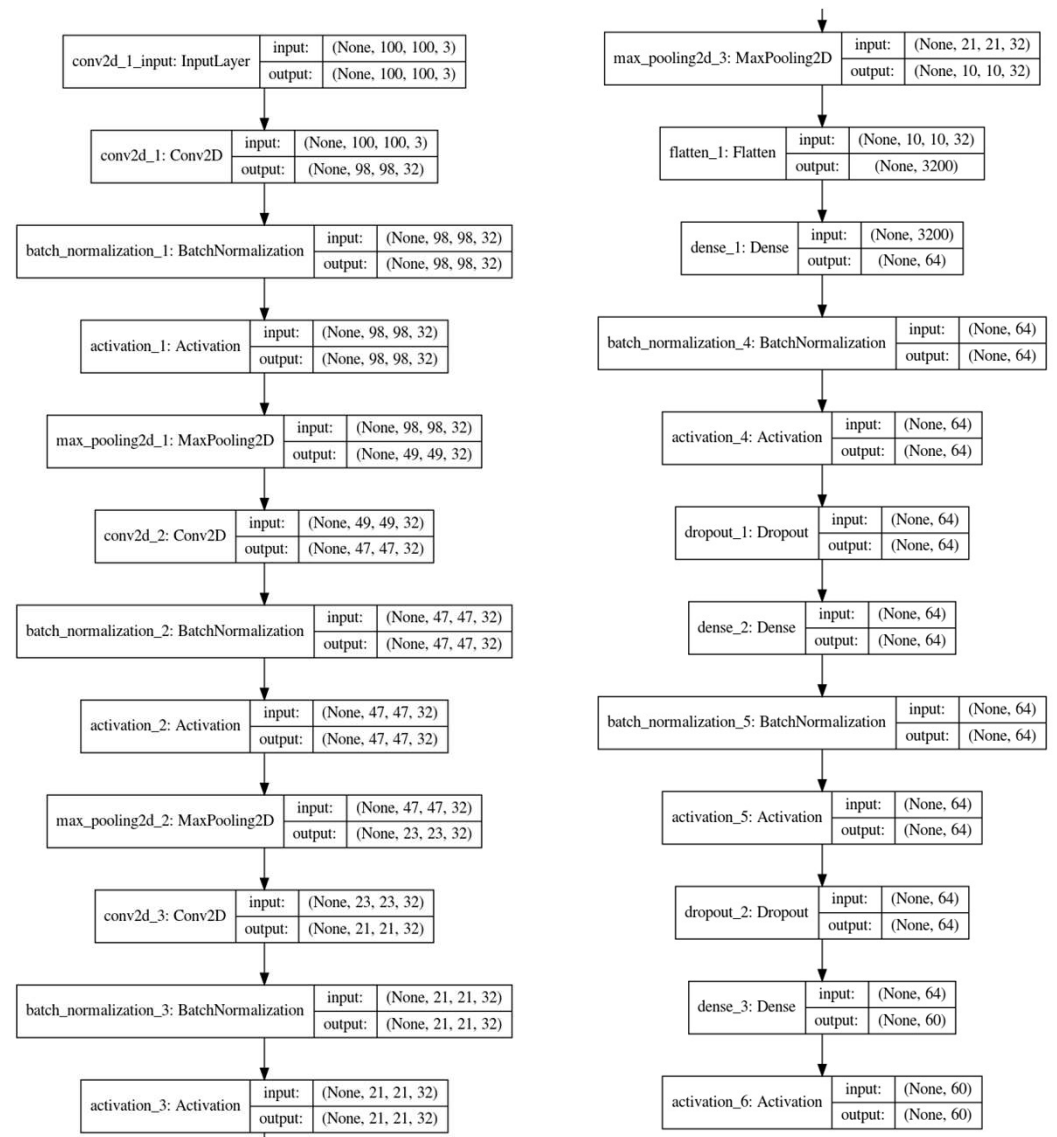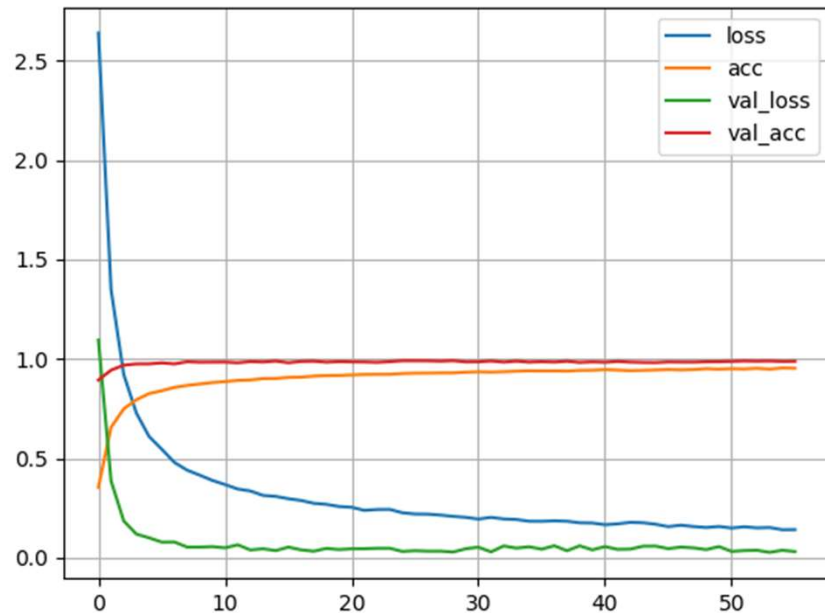
CNN SIMPLE

Number of Parameters	233'212
Trainable Parameters	232'764
Non-trainable Parameters	448
Batch-size	128
Number of CNN-Layers	3 (32 filters)
Number of Dense-Layers	1 (64 filters)
Dropout	0.5
Max-Pooling	Applied
Decay	Not applied
Data Normalization	Applied
Data Augmentation	Not Applied
Number of Epochs	55
Activation Formula	ReLU
Loss Function	categorical_crossentropy
Optimizer	adam

CNN ADVANCED
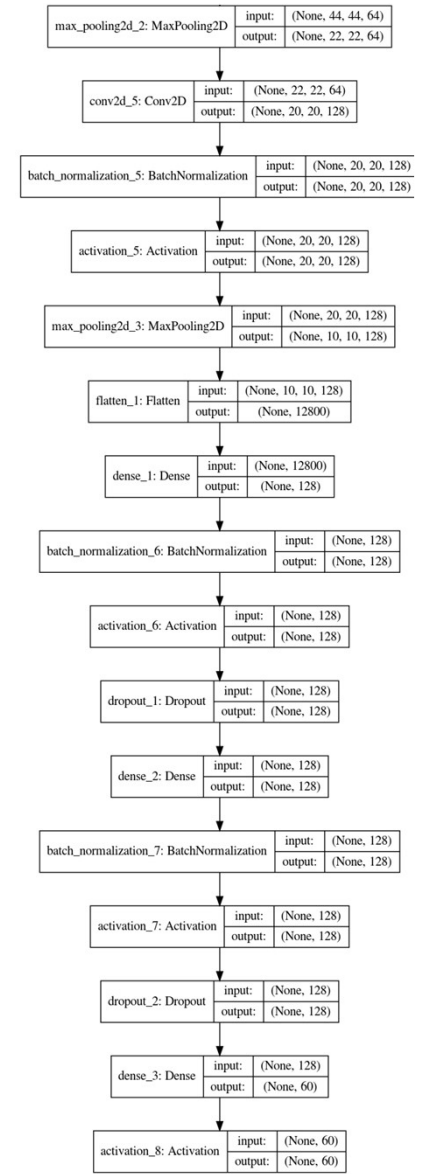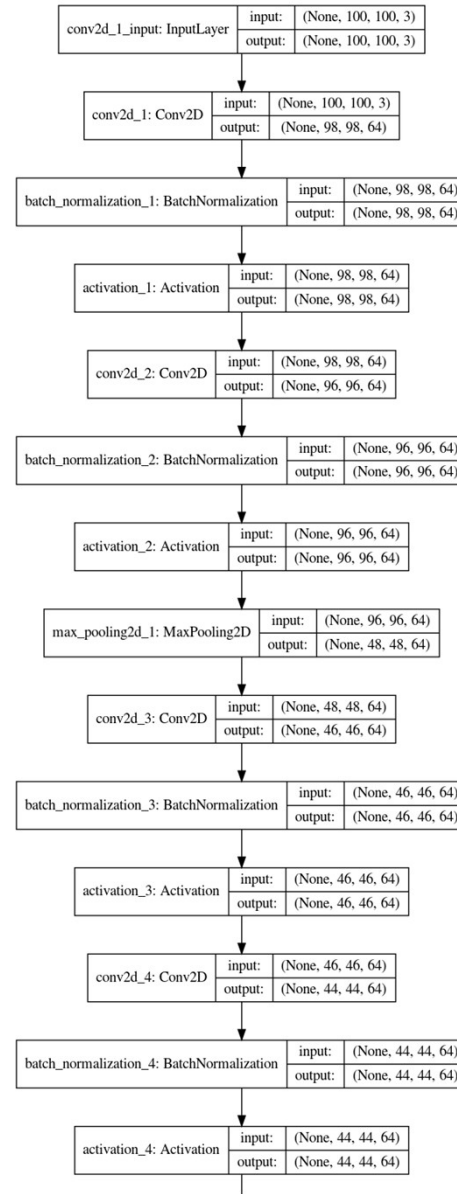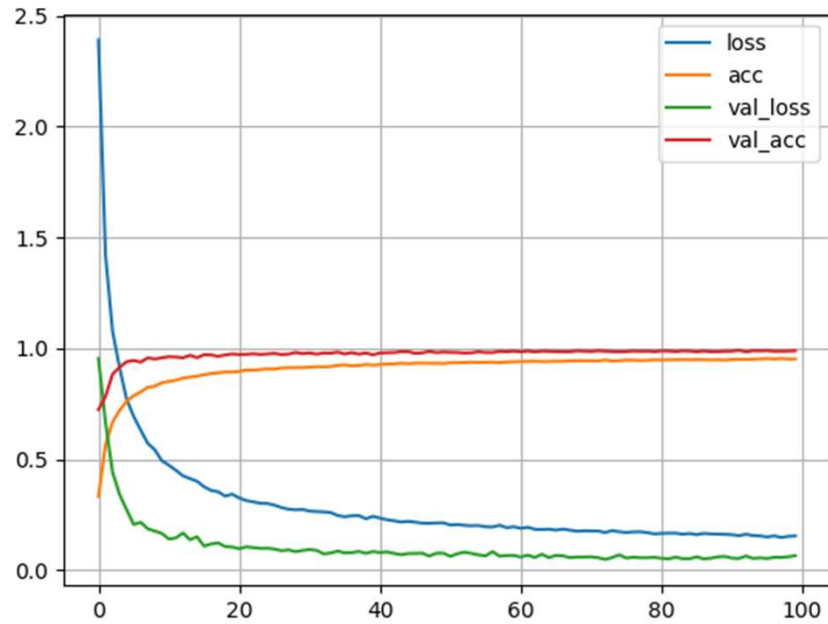
CNN ADV

Number of Parameters	1'851'772
Trainable Parameters	1'850'492
Non-trainable Parameters	1'280
Batch-size	64
Number of CNN-Layers	5 (64 & 128 filters)
Number of Dense-Layers	2 (128 filters)
Dropout	0.5, 0.5
Max-Pooling	Applied
Decay	Applied
Data Normalization	Applied
Data Augmentation	Applied
Number of Epochs	100
Activation Formula	ReLU
Loss Function	categorical_crossentropy
Optimizer	adam