TITLE
AUTHOR

Contents

1 Summary

№	Model name	#Parameters	#Epochs	Batch size	Test Acc.	Training Acc.
1	ConvNet2layers	1 199 882	5	64	98.76 %	99.33 %
2	MLP2layers	669 706	5	64	91.15 %	90.93 %
3	MLP5layers	1 457 674	5	64	92.47 %	91.97 %

2   Training reports

2.1   Model 1: ConvNet2layers

Training history   See Figure 1.

(a) Accuracy learning process for model 1.

(b) Loss learning process for model 1.

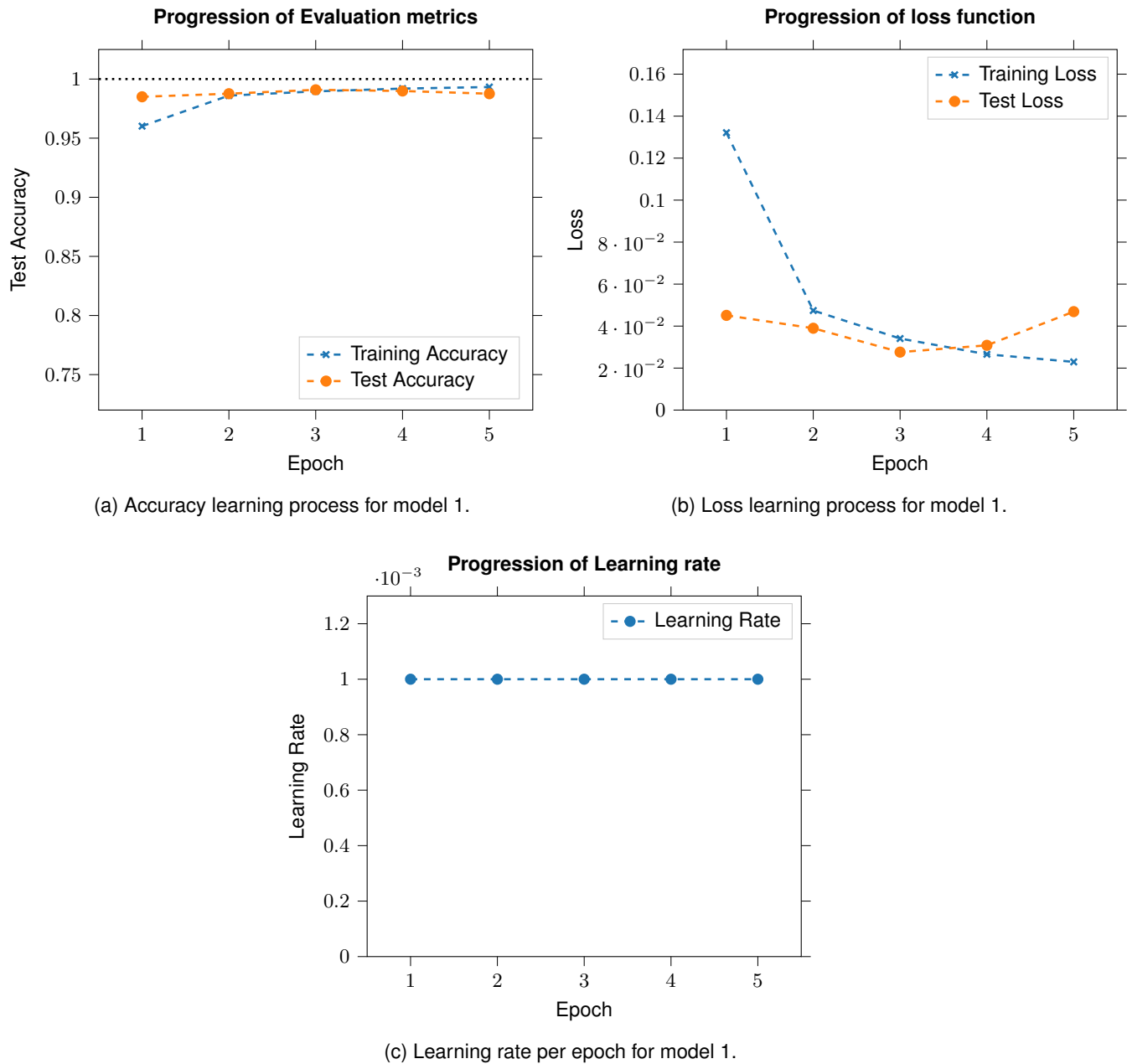(c) Learning rate per epoch for model 1.

Figure 1: Training and evaluation metrics for model 1.

Dataset

Name MNIST

Train-Test-Dev split: *Training set:* 60000, *Test set:* 10000, *Dev set:* 0,

Image size [28, 28]

Training

Number of epochs 5

Optimizer RMSProp

Learning Rate	0.00010000000474974513
Rho	0.8999999761581421
Decay	0.0
Epsilon	1e-07

Loss Categorical crossentropy

Batch size 64

Shuffle Yes

Training time 52 sec

Platform

Weights exported to path weights\ConvNet2layers_5ep_MNIST.h5

Device used GPU (GeForce GTX 1060 6GB)

CPU Intel(R) Xeon(R) CPU E3-1245 v5 @ 3.50GHz, X86_64

Python Version 3.7.2.final.0 (64 bit)

Keras Version 2.2.5 (Backend: tensorflow)

Tensorflow Version 1.14.0

Timestamp 26.09.2019 at 10:07

2.2 Model 2: MLP2layers

Training history   See Figure 2.

(a) Accuracy learning process for model 2.

(b) Loss learning process for model 2.

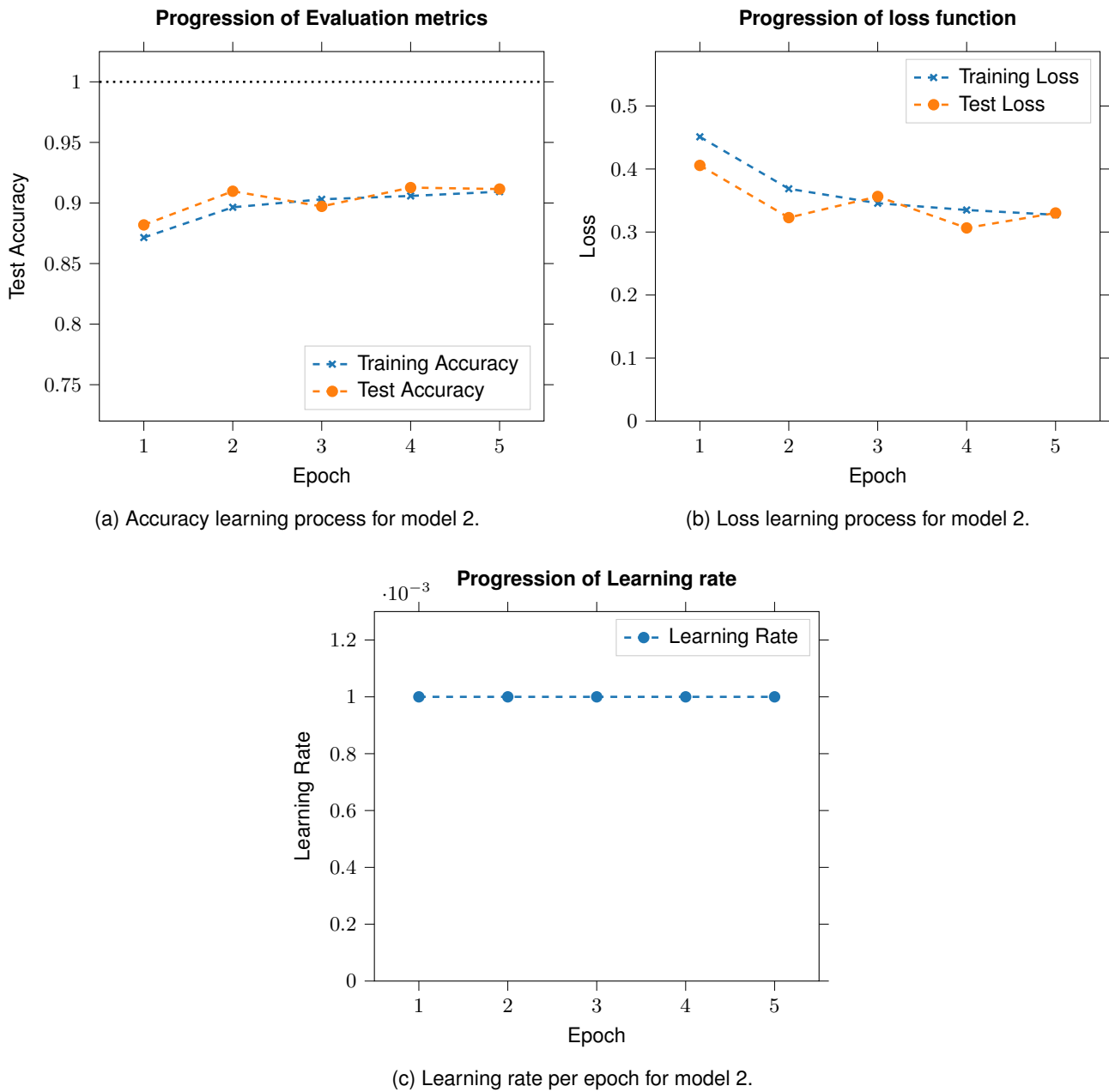
(c) Learning rate per epoch for model 2.

Figure 2: Training and evaluation metrics for model 2.

Dataset

Name MNIST

Train-Test-Dev split: *Training set:* 60000, *Test set:* 10000, *Dev set:* 0,

Image size [28, 28]

Training

Number of epochs 5

Optimizer RMSProp

Learning Rate	0.0010000000474974513
Rho	0.8999999761581421
Decay	0.0
Epsilon	1e-07

Loss Categorical crossentropy

Batch size 64

Shuffle Yes

Training time 29 sec

Platform

Weights exported to path weights\MLP2layers_5ep_MNIST.h5

Device used GPU (GeForce GTX 1060 6GB)

CPU Intel(R) Xeon(R) CPU E3-1245 v5 @ 3.50GHz, X86_64

Python Version 3.7.2.final.0 (64 bit)

Keras Version 2.2.5 (Backend: tensorflow)

Tensorflow Version 1.14.0

Timestamp 26.09.2019 at 10:08

2.3 Model 3: MLP5layers

Training history   See Figure 3.

(a) Accuracy learning process for model 3.

(b) Loss learning process for model 3.

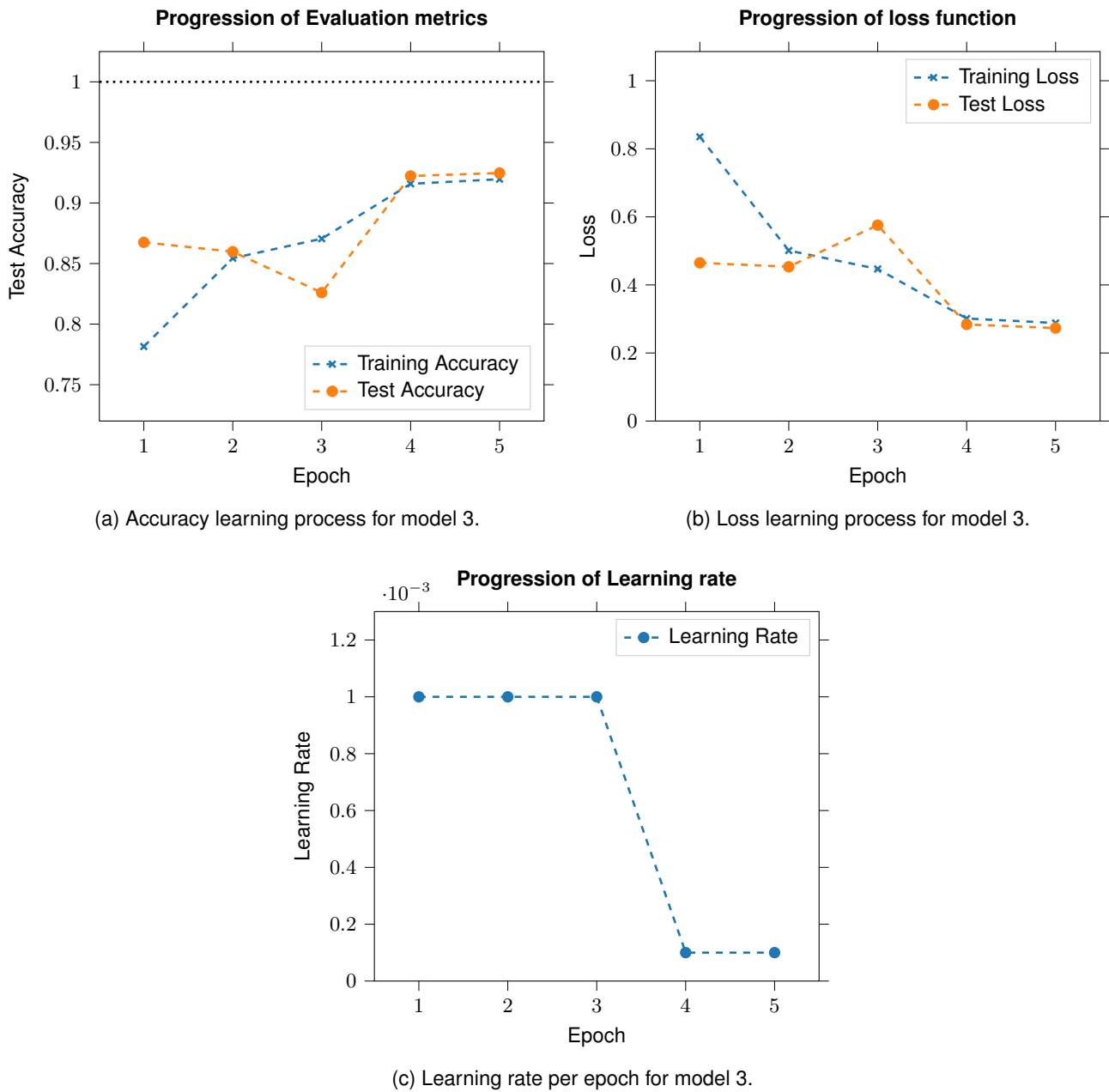

(c) Learning rate per epoch for model 3.

Figure 3: Training and evaluation metrics for model 3.

Dataset

Name MNIST

Train-Test-Dev split: *Training set:* 60000, *Test set:* 10000, *Dev set:* 0,

Image size [28, 28]

Training

Number of epochs 5

Optimizer RMSProp

Learning Rate	0.00010000000474974513
Rho	0.8999999761581421
Decay	0.0
Epsilon	1e-07

Loss Categorical crossentropy

Batch size 64

Shuffle Yes

Training time 39 sec

Platform

Weights exported to path weights\MLP5layers_5ep_MNIST.h5

Device used GPU (GeForce GTX 1060 6GB)

CPU Intel(R) Xeon(R) CPU E3-1245 v5 @ 3.50GHz, X86_64

Python Version 3.7.2.final.0 (64 bit)

Keras Version 2.2.5 (Backend: tensorflow)

Tensorflow Version 1.14.0

Timestamp 26.09.2019 at 10:09

3 Model Architectures

3.1 ConvNet2layers

Used in №: 3

Model summary:

№	Layer (Type)	Output shape	Config	#Parameters	Inbound layers
0	input_1 (InputLayer)	(28, 28, 1)		0	
1	conv2d_1 (Conv2D)	(26, 26, 32)	**Activation:** relu **Kernel Size:** [3, 3] **Stride:** [1, 1] **Dilation:** [1, 1] **Padding:** valid	320	input_1
2	conv2d_2 (Conv2D)	(24, 24, 64)	**Activation:** relu **Kernel Size:** [3, 3] **Stride:** [1, 1] **Dilation:** [1, 1] **Padding:** valid	18 496	conv2d_1
3	max_pooling2d_1 (MaxPooling2D)	(12, 12, 64)	**Pool size:** [2, 2] **Strides:** [2, 2] **Padding:** valid	0	conv2d_2
4	dropout_1 (Dropout)	(12, 12, 64)	**Dropout Rate:** 0.0	0	max_pooling2d_1
5	flatten_1 (Flatten)	(9216,)		0	dropout_1
6	dense_1 (Dense)	(128,)	**#Neurons:** 128 **Activation:** relu	1 179 776	flatten_1
7	dropout_2 (Dropout)	(128,)	**Dropout Rate:** 0.2	0	dense_1
8	dense_2 (Dense)	(10,)	**#Neurons:** 10 **Activation:** softmax	1290	dropout_2

3.2 MLP5layers

Used in №: 3

Model summary:

№	Layer (Type)	Output shape	Config	#Parameters	Inbound layers
0	input_3 (InputLayer)	(28, 28, 1)		0	
1	flatten_3 (Flatten)	(784,)		0	input_3
2	dense_6 (Dense)	(512,)	**#Neurons:** 512 **Activation:** linear	401 920	flatten_3
3	dropout_5 (Dropout)	(512,)	**Dropout Rate:** 0.0	0	dense_6
4	dense_7 (Dense)	(512,)	**#Neurons:** 512 **Activation:** linear	262 656	dropout_5
5	dropout_6 (Dropout)	(512,)	**Dropout Rate:** 0.0	0	dense_7
6	dense_8 (Dense)	(512,)	**#Neurons:** 512 **Activation:** linear	262 656	dropout_6
7	dropout_7 (Dropout)	(512,)	**Dropout Rate:** 0.0	0	dense_8
8	dense_9 (Dense)	(512,)	**#Neurons:** 512 **Activation:** linear	262 656	dropout_7
9	dropout_8 (Dropout)	(512,)	**Dropout Rate:** 0.2	0	dense_9
10	dense_10 (Dense)	(512,)	**#Neurons:** 512 **Activation:** linear	262 656	dropout_8
11	dropout_9 (Dropout)	(512,)	**Dropout Rate:** 0.2	0	dense_10
12	dense_11 (Dense)	(10,)	**#Neurons:** 10 **Activation:** softmax	5130	dropout_9

3.3 MLP2layers

Used in №: 3

Model summary:

№	Layer (Type)	Output shape	Config	#Parameters	Inbound layers
0	input_2 (InputLayer)	(28, 28, 1)		0	
1	flatten_2 (Flatten)	(784,)		0	input_2
2	dense_3 (Dense)	(512,)	**#Neurons:** 512 **Activation:** linear	401 920	flatten_2
3	dropout_3 (Dropout)	(512,)	**Dropout Rate:** 0.0	0	dense_3
4	dense_4 (Dense)	(512,)	**#Neurons:** 512 **Activation:** linear	262 656	dropout_3
5	dropout_4 (Dropout)	(512,)	**Dropout Rate:** 0.2	0	dense_4
6	dense_5 (Dense)	(10,)	**#Neurons:** 10 **Activation:** softmax	5130	dropout_4