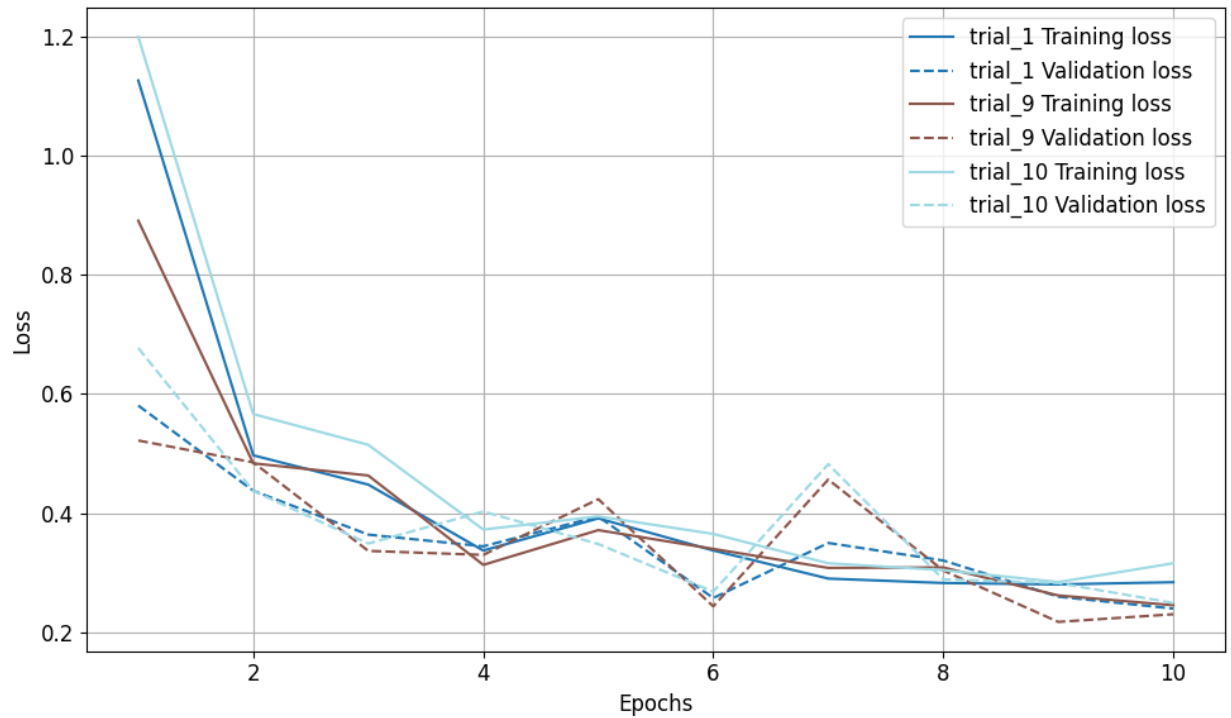
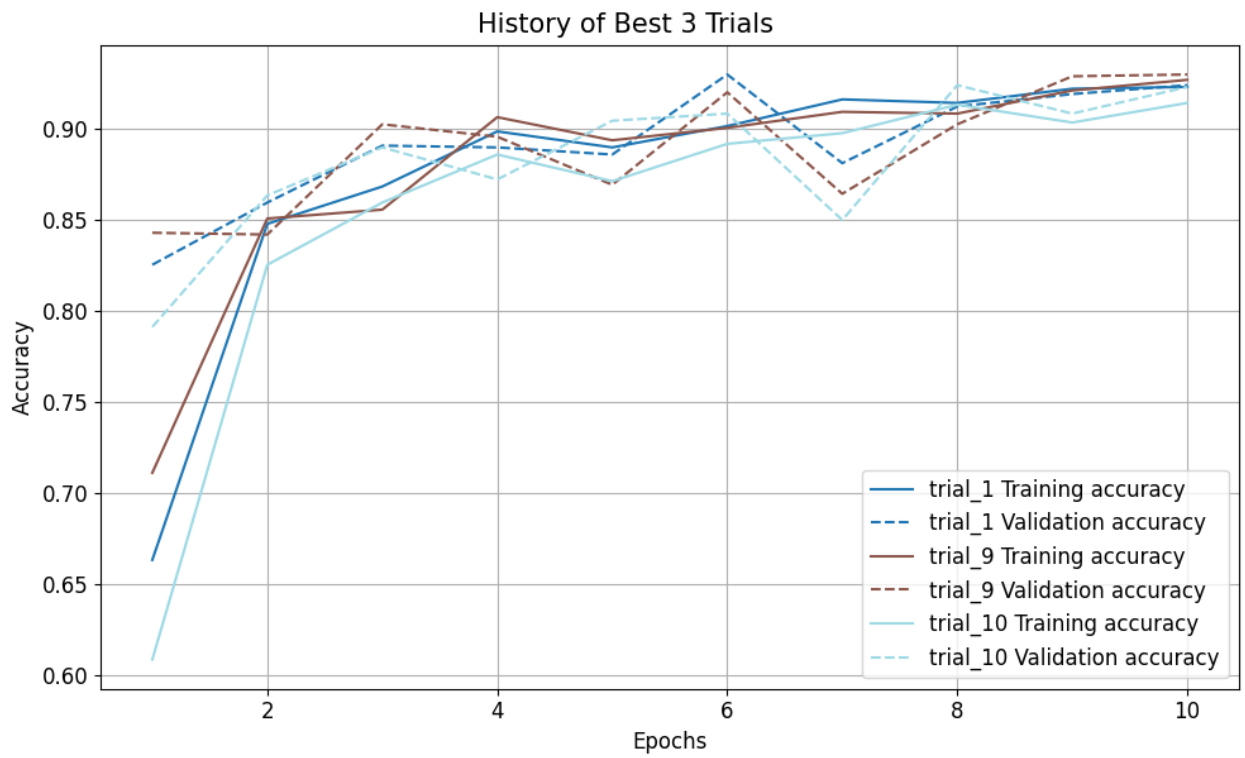


Experiment Report: MNIST Digits Experiment (Automatic)

Metadata

- *Description:* In this experiment, a neural network is trained with different hyperparameters to classify MNIST digits.
- *Start Time:* 2025-03-12 15:28:06
- *Last Resume Time:* 2025-03-12 15:32:27
- *Total Duration:* 0:02:10.094
- *Directory:* [Link](#)

Initial Visualizations



Summary

Hyperparameters

	units1	units2	learning_rate	Chapters
trial_1	128	32	0.0015	Chapter
trial_9	128	128	0.0035	Chapter
trial_10	32	64	0.0033	Chapter
trial_7	128	64	0.0133	Chapter
trial_6	32	64	0.0057	Chapter
trial_3	128	128	0.0134	Chapter
trial_8	128	64	0.0285	Chapter
trial_5	32	64	0.0250	Chapter
trial_4	64	128	0.0248	Chapter
trial_2	32	128	0.0357	Chapter

Test Results

	accuracy	precision	recall	f1	Chapters
trial_1	0.9870	0.9519	0.9187	0.9350	Chapter
trial_9	0.9851	0.9388	0.9143	0.9264	Chapter
trial_10	0.9850	0.9448	0.9063	0.9252	Chapter
trial_7	0.9829	0.9388	0.9002	0.9191	Chapter
trial_6	0.9789	0.9208	0.8679	0.8936	Chapter
trial_3	0.9785	0.9322	0.8609	0.8951	Chapter
trial_8	0.9767	0.9265	0.8494	0.8863	Chapter
trial_5	0.9753	0.9180	0.8366	0.8754	Chapter
trial_4	0.9649	0.8832	0.7526	0.8127	Chapter

	accuracy	precision	recall	f1	Chapters
trial_2	0.8910	0.6990	0.2681	0.3875	Chapter

trial_1

- *Start Time:* 2025-03-12 15:32:27
- *Duration:* 13.710
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	128
units2	32
learning_rate	0.0015234195168745124

Evaluation Metrics:

	train	val	test
accuracy	0.9861	0.9847	0.9870
precision	0.9463	0.9427	0.9519
recall	0.9145	0.9064	0.9187
f1	0.9301	0.9242	0.9350

Figures:

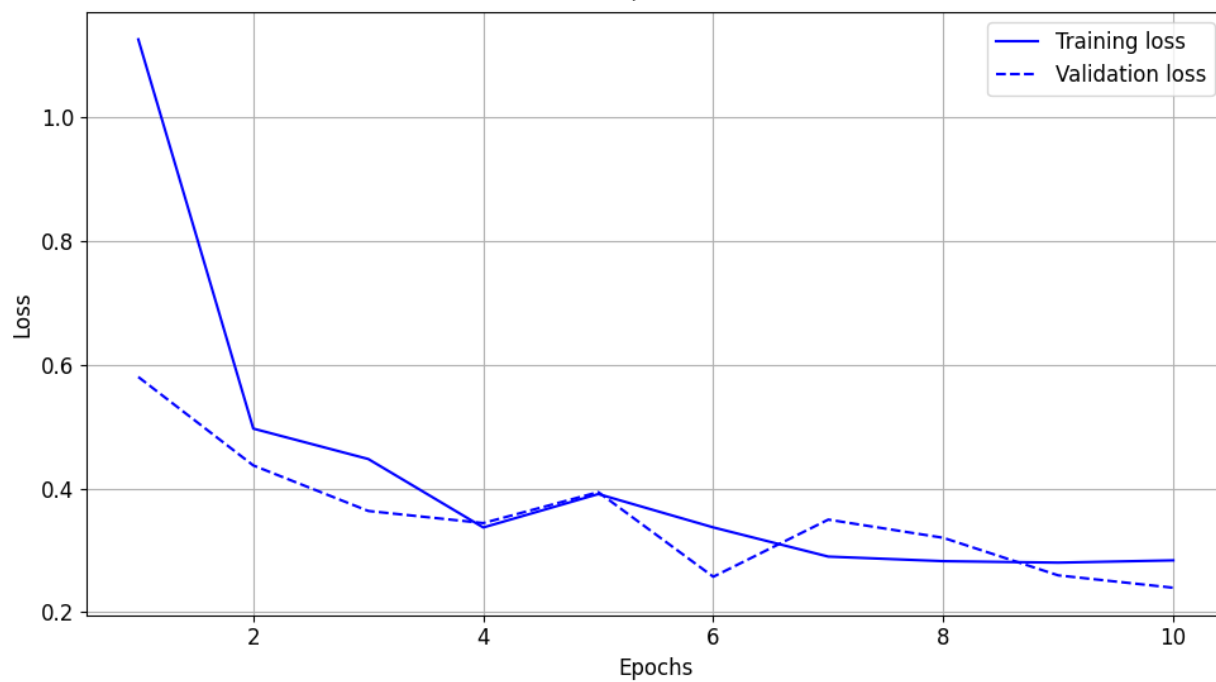
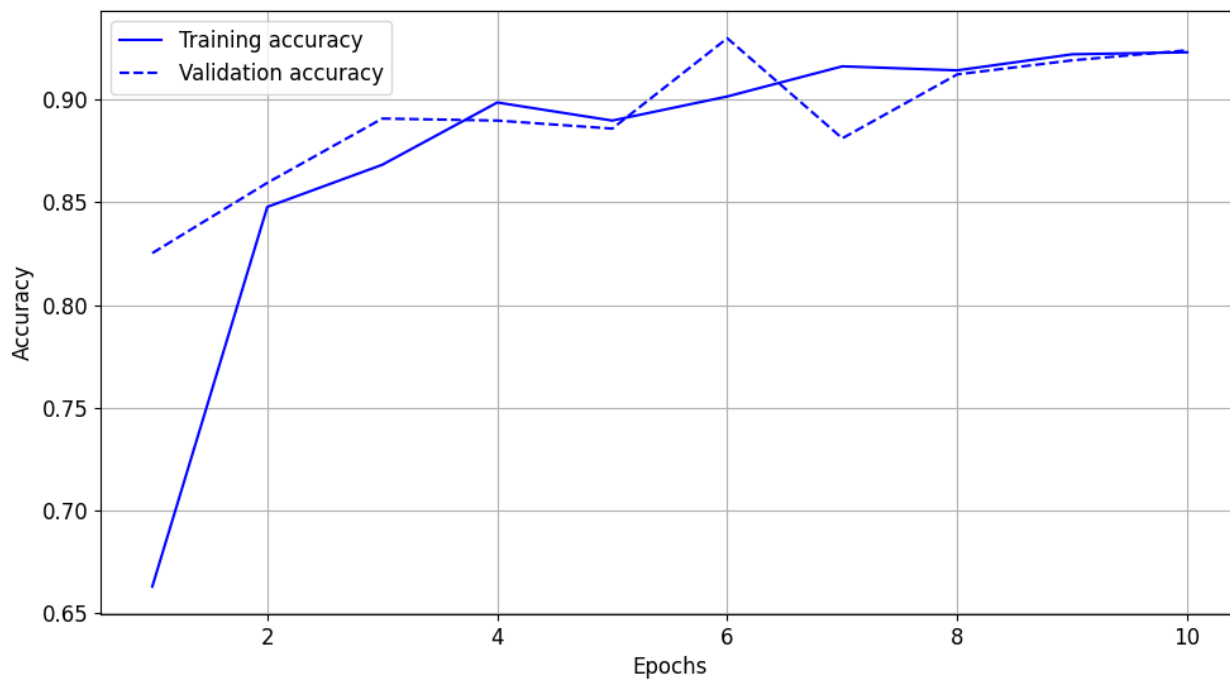
Model Summary

Model: "sequential"

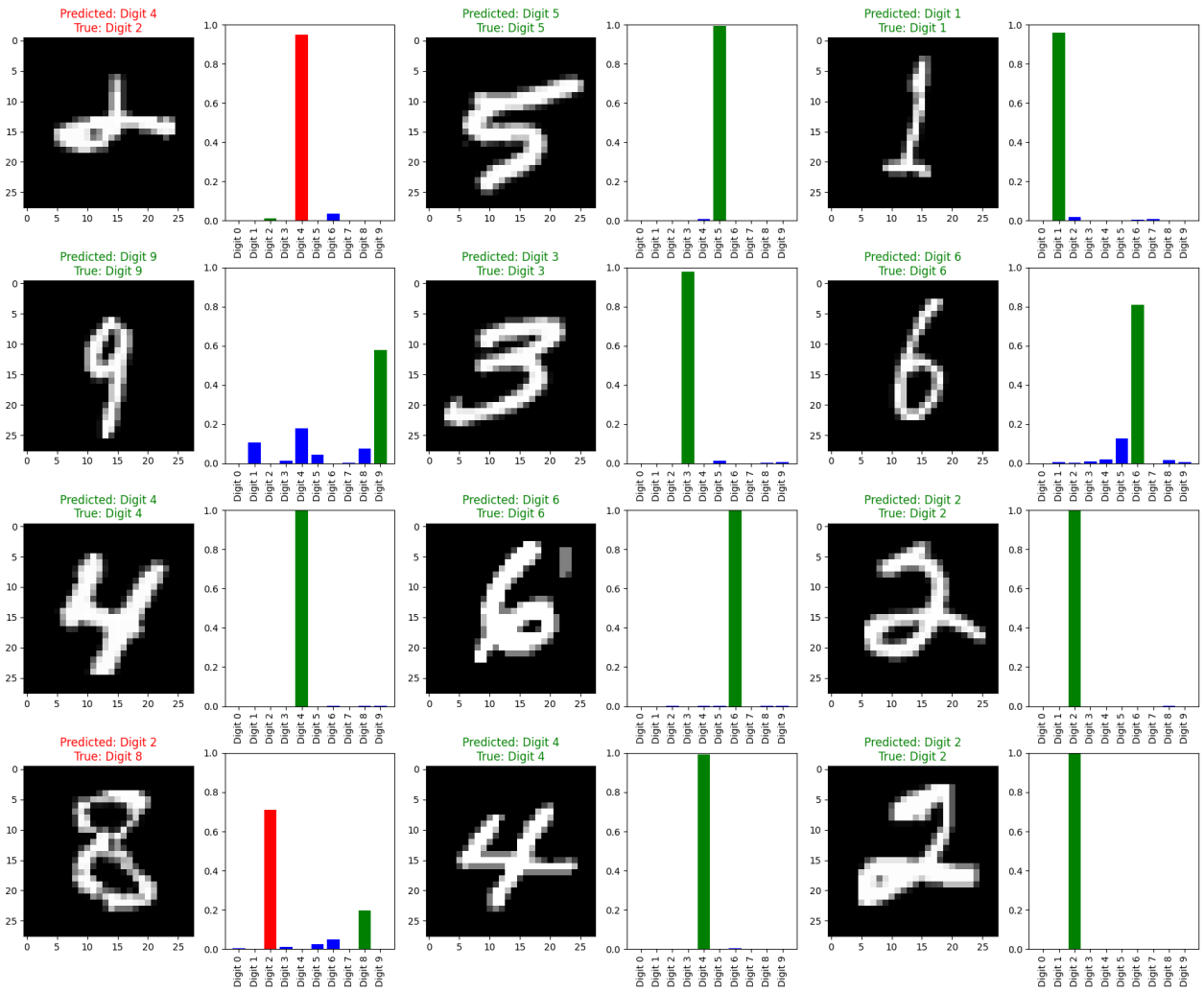
Layer (type)	Output Shape	Param #
flatten (Flatten)	(None, 2352)	0
dense (Dense)	(None, 128)	301,184
dense_1 (Dense)	(None, 32)	4,128
dense_2 (Dense)	(None, 10)	330

Total params: 916,928 (3.50 MB)
Trainable params: 305,642 (1.17 MB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 611,286 (2.33 MB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9665	0.9582	0.9623	693
Digit 1	0.9431	0.9795	0.9609	829
Digit 2	0.9005	0.9437	0.9216	710
Digit 3	0.9209	0.9016	0.9111	671
Digit 4	0.9509	0.9342	0.9425	684
Digit 5	0.9106	0.9258	0.9181	660
Digit 6	0.9766	0.9515	0.9639	701
Digit 7	0.9535	0.9469	0.9502	715
Digit 8	0.9098	0.9045	0.9071	691
Digit 9	0.9141	0.8896	0.9017	670
micro avg	0.9348	0.9348	0.9348	7024
macro avg	0.9346	0.9335	0.9339	7024
weighted avg	0.9350	0.9348	0.9348	7024
samples avg	0.9348	0.9348	0.9348	7024

trial_9

- *Start Time:* 2025-03-12 15:34:10
- *Duration:* 12.388
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	128
units2	128
learning_rate	0.0034716752942109113

Evaluation Metrics:

	train	val	test
accuracy	0.9853	0.9844	0.9851
precision	0.9393	0.9387	0.9388
recall	0.9153	0.9103	0.9143
f1	0.9271	0.9242	0.9264

Figures:

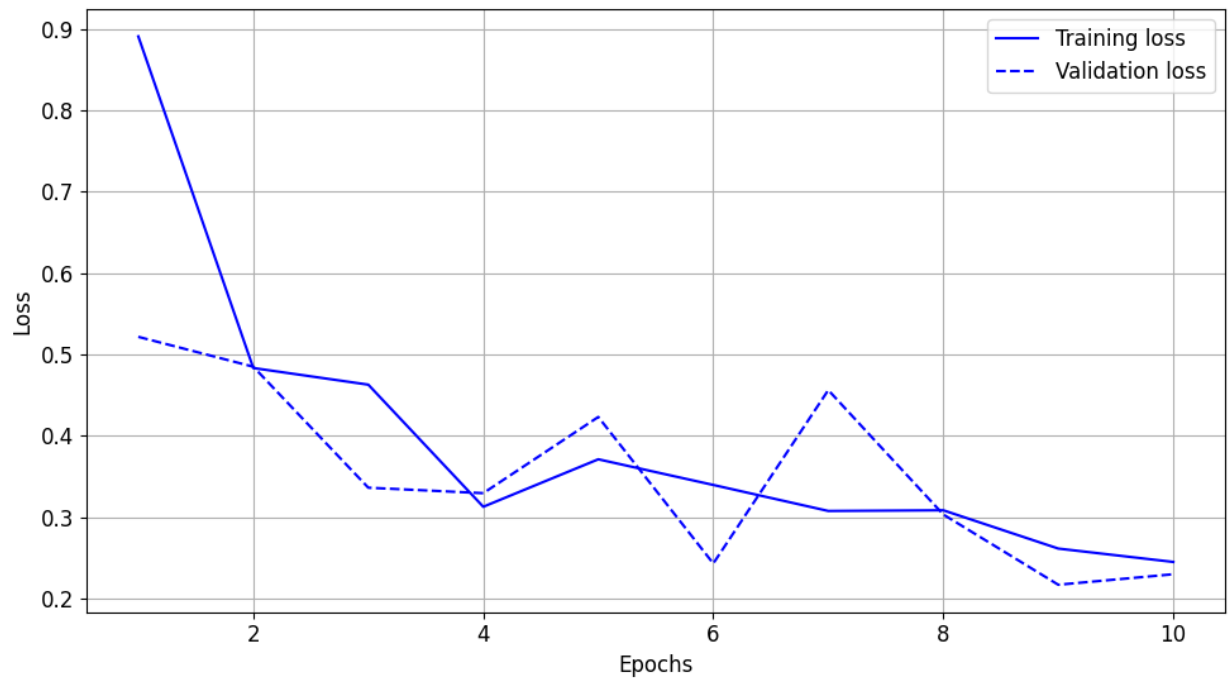
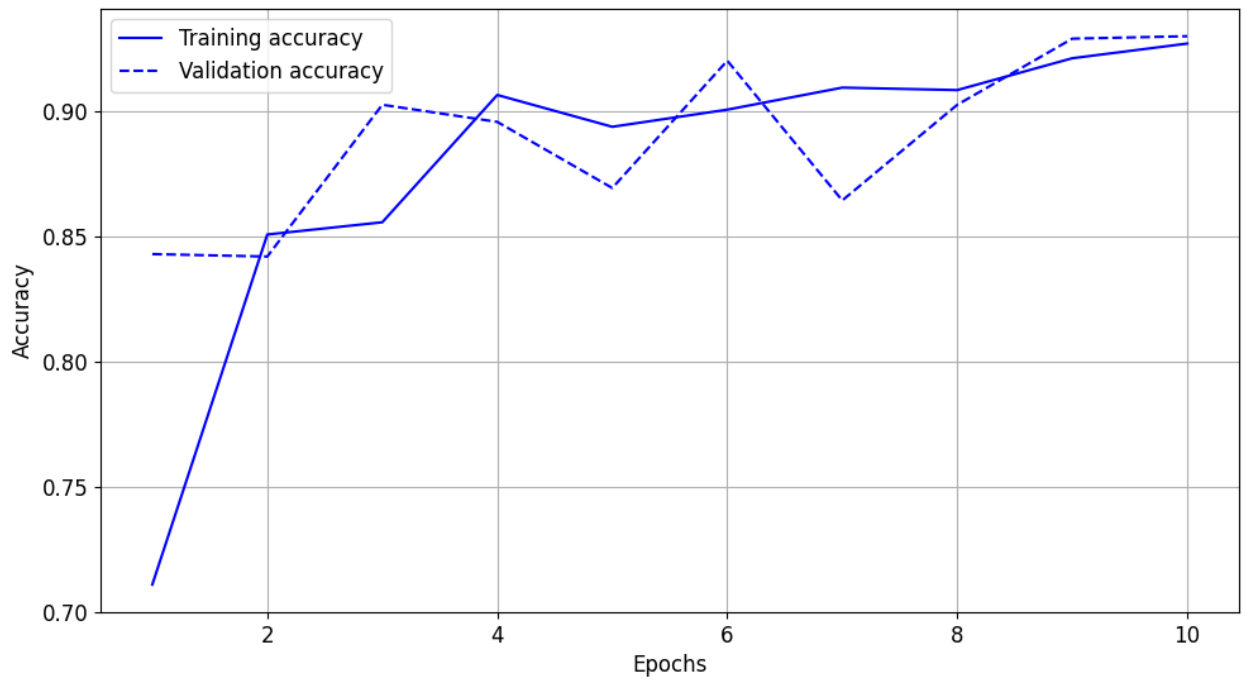
Model Summary

Model: "sequential_8"

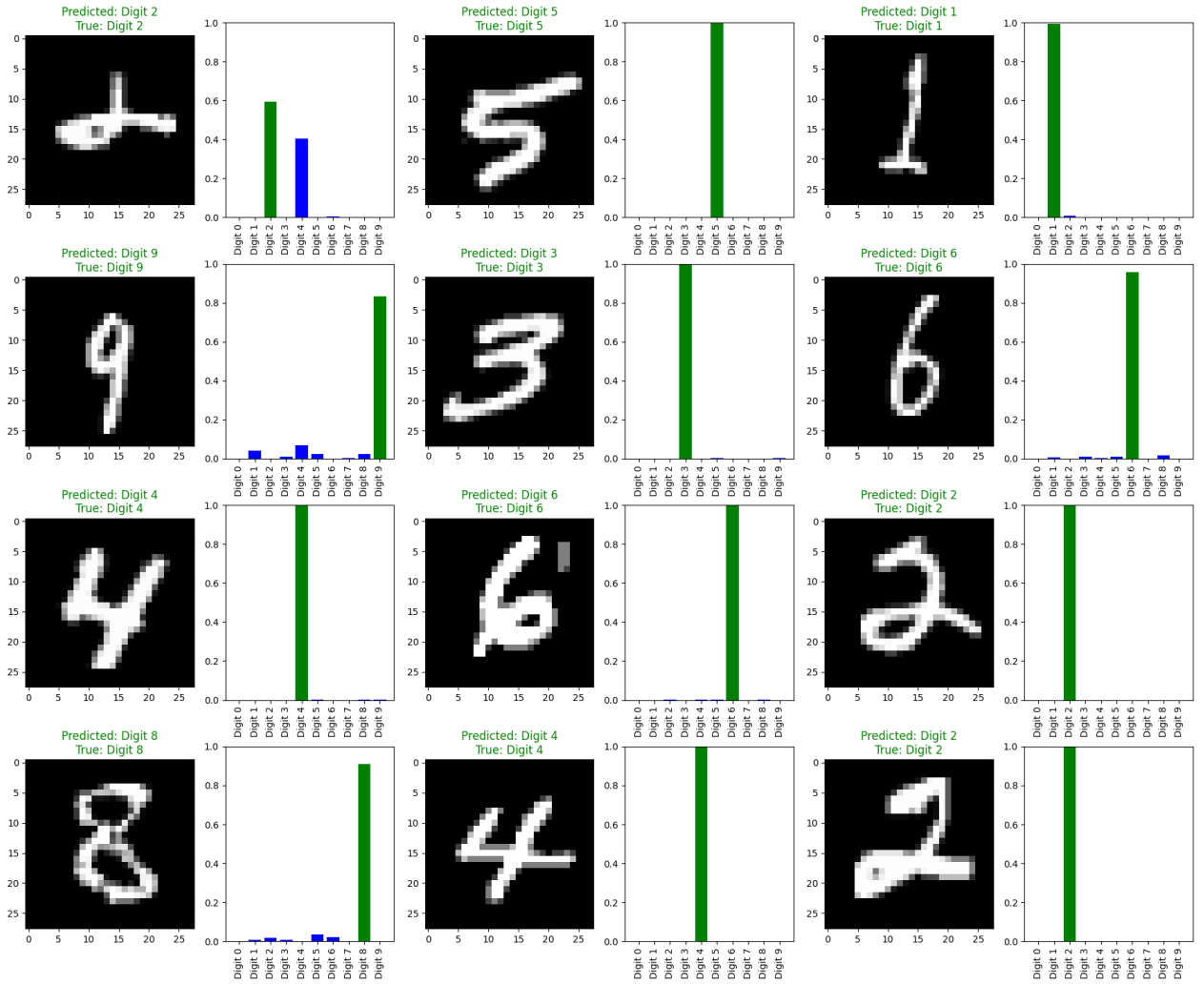
Layer (type)	Output Shape	Param #
flatten_8 (Flatten)	(None, 2352)	0
dense_24 (Dense)	(None, 128)	301,184
dense_25 (Dense)	(None, 128)	16,512
dense_26 (Dense)	(None, 10)	1,290

Total params: 956,960 (3.65 MB)
Trainable params: 318,986 (1.22 MB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 637,974 (2.43 MB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9577	0.9466	0.9521	693
Digit 1	0.9518	0.9771	0.9643	829
Digit 2	0.9060	0.9366	0.9211	710
Digit 3	0.8558	0.9374	0.8947	671
Digit 4	0.9570	0.9108	0.9333	684
Digit 5	0.8879	0.9121	0.8999	660
Digit 6	0.9850	0.9372	0.9605	701
Digit 7	0.9747	0.9175	0.9452	715
Digit 8	0.8838	0.8915	0.8876	691
Digit 9	0.8959	0.8731	0.8844	670
micro avg	0.9253	0.9253	0.9253	7024
macro avg	0.9256	0.9240	0.9243	7024
weighted avg	0.9267	0.9253	0.9255	7024
samples avg	0.9253	0.9253	0.9253	7024

trial_10

- *Start Time:* 2025-03-12 15:34:24
- *Duration:* 11.415
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	32
units2	64
learning_rate	0.0032756369286111382

Evaluation Metrics:

	train	val	test
accuracy	0.9852	0.9835	0.9850
precision	0.9452	0.9383	0.9448
recall	0.9081	0.8997	0.9063
f1	0.9263	0.9186	0.9252

Figures:

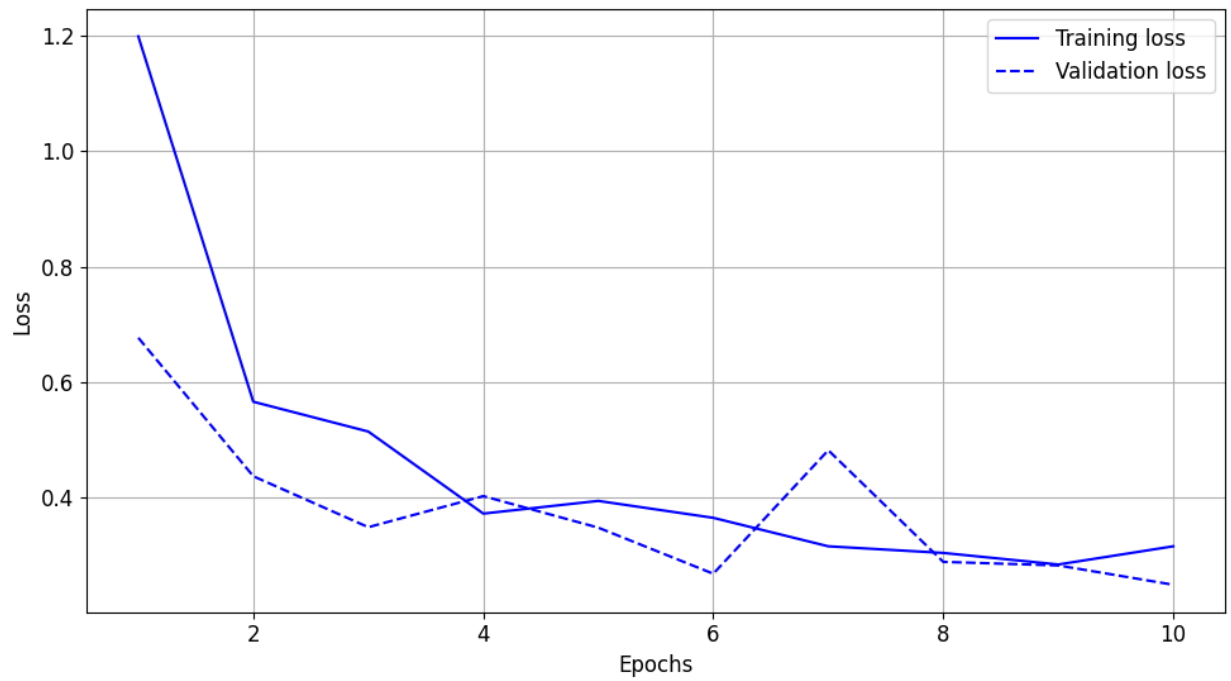
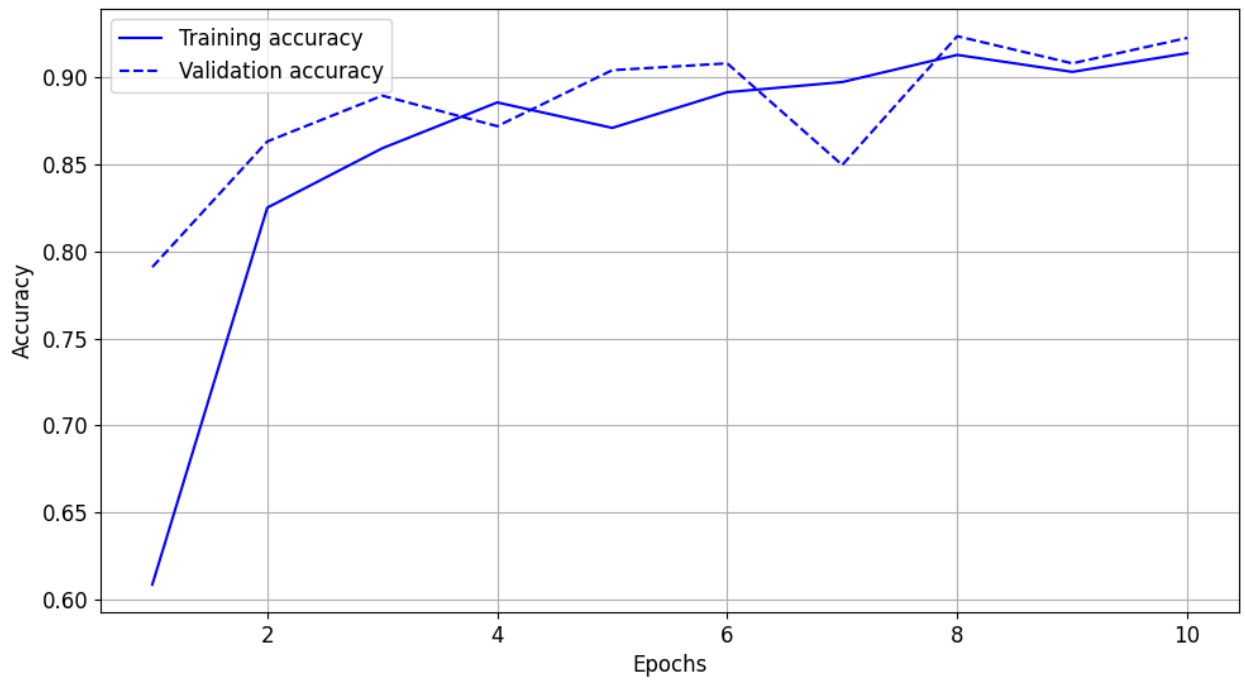
Model Summary

Model: "sequential_9"

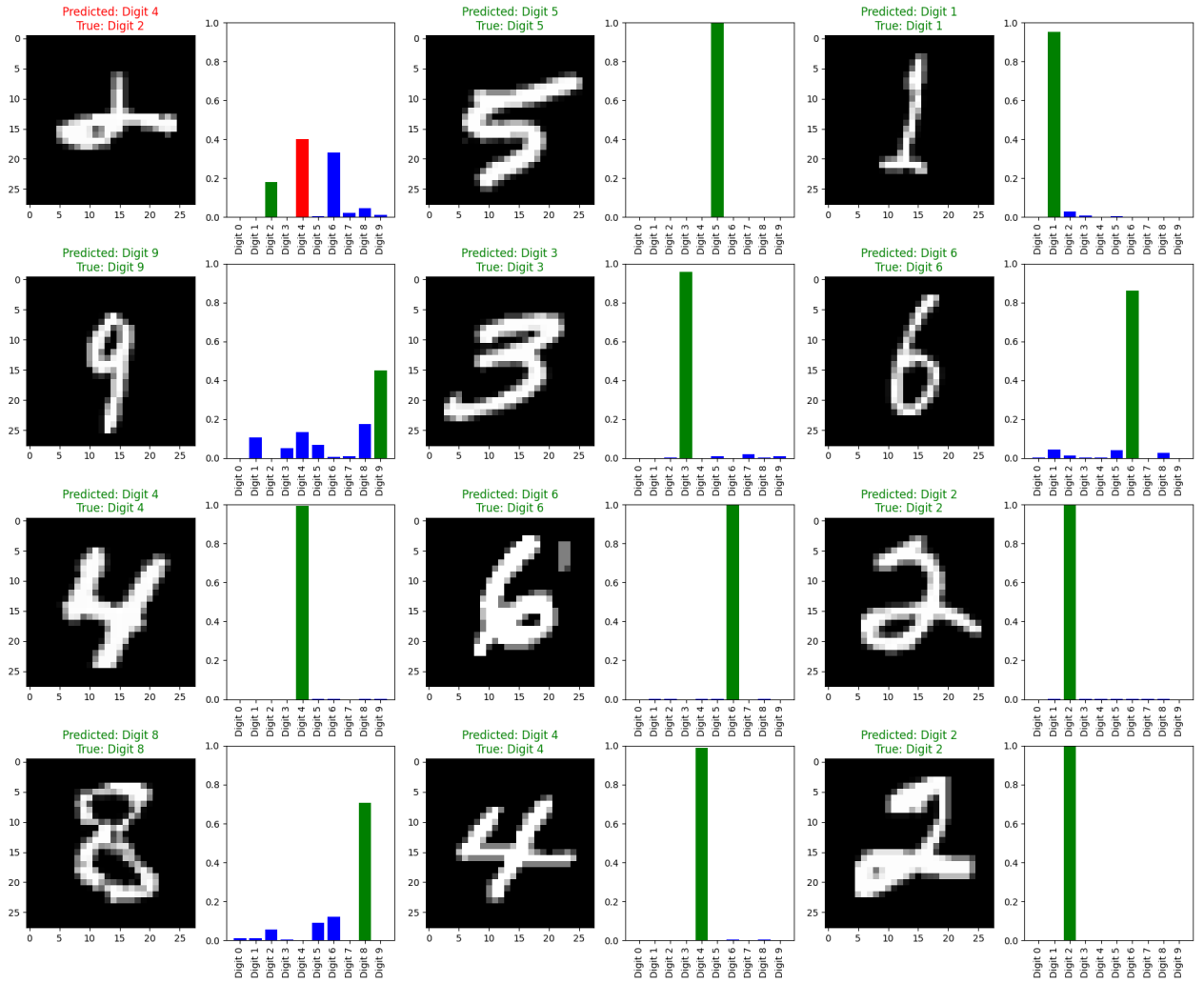
Layer (type)	Output Shape	Param #
flatten_9 (Flatten)	(None, 2352)	0
dense_27 (Dense)	(None, 32)	75,296
dense_28 (Dense)	(None, 64)	2,112
dense_29 (Dense)	(None, 10)	650

Total params: 234,176 (914.75 KB)
Trainable params: 78,058 (304.91 KB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 156,118 (609.84 KB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9502	0.9639	0.9570	693
Digit 1	0.9585	0.9747	0.9665	829
Digit 2	0.9019	0.9197	0.9107	710
Digit 3	0.8898	0.9270	0.9080	671
Digit 4	0.9578	0.9298	0.9436	684
Digit 5	0.8678	0.8955	0.8814	660
Digit 6	0.9746	0.9301	0.9518	701
Digit 7	0.9302	0.9510	0.9405	715
Digit 8	0.8854	0.9059	0.8956	691
Digit 9	0.9303	0.8373	0.8814	670
micro avg	0.9250	0.9250	0.9250	7024
macro avg	0.9247	0.9235	0.9237	7024
weighted avg	0.9257	0.9250	0.9249	7024
samples avg	0.9250	0.9250	0.9250	7024

trial_7

- *Start Time:* 2025-03-12 15:33:45
- *Duration:* 11.576
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	128
units2	64
learning_rate	0.013301330591864046

Evaluation Metrics:

	train	val	test
accuracy	0.9832	0.9821	0.9829
precision	0.9400	0.9363	0.9388
recall	0.8985	0.8912	0.9002
f1	0.9188	0.9132	0.9191

Figures:

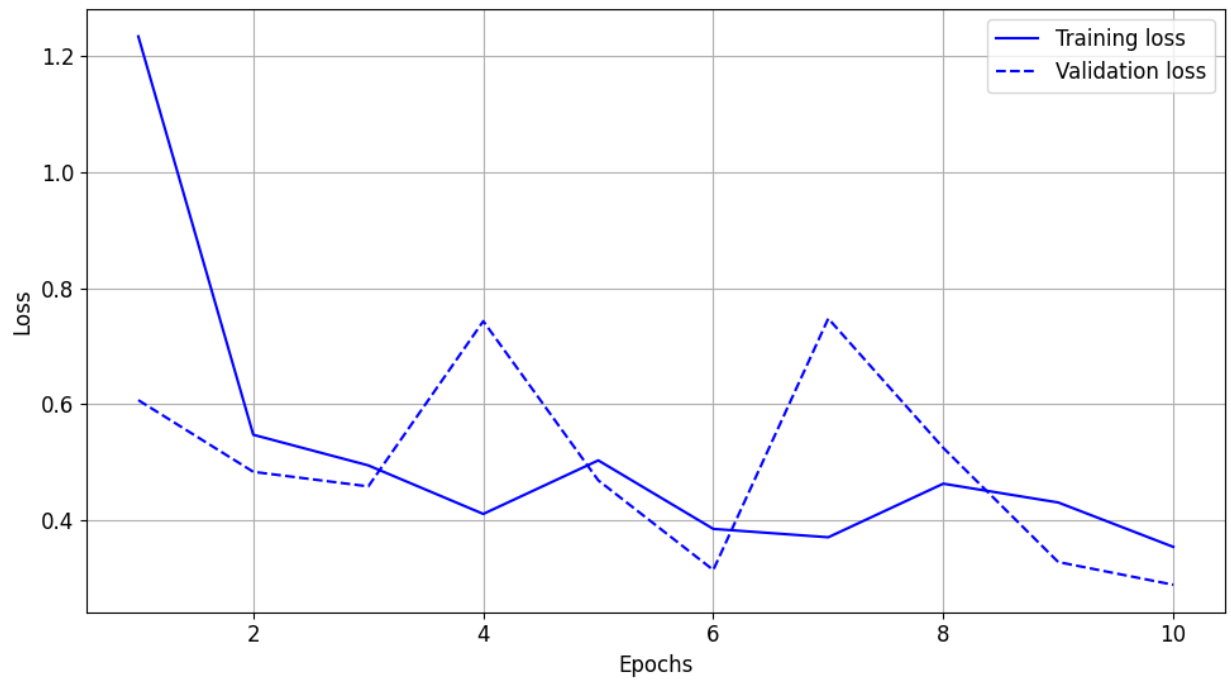
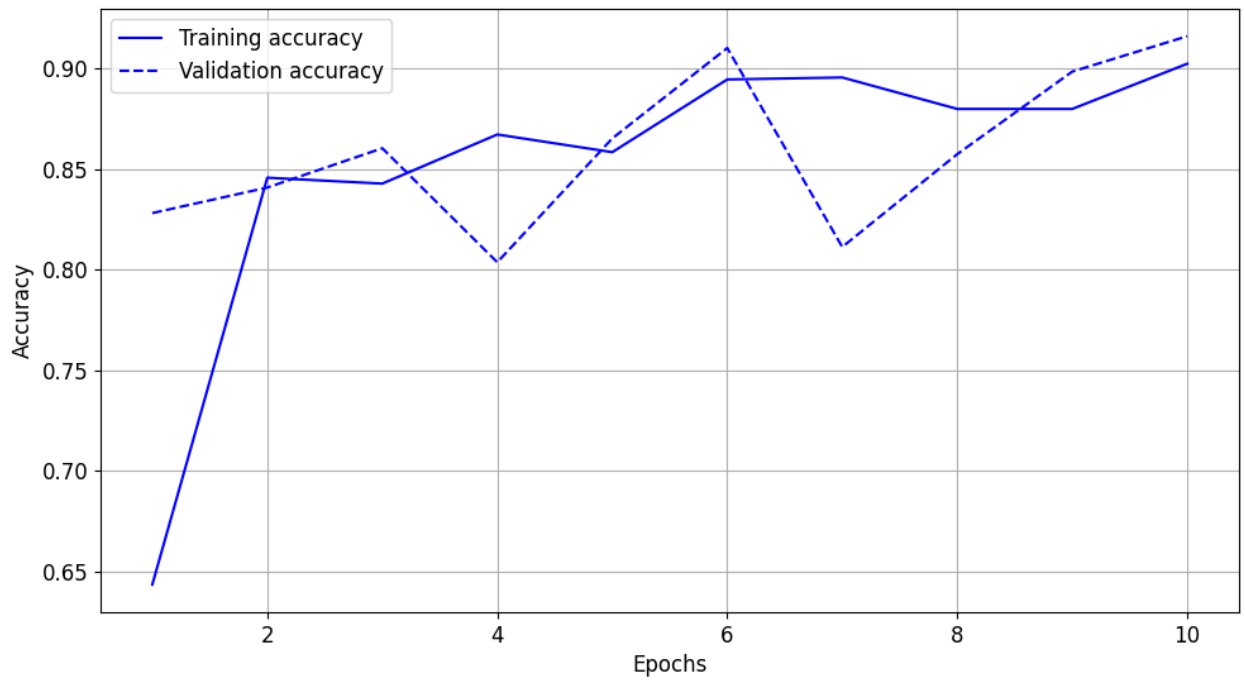
Model Summary

Model: "sequential_6"

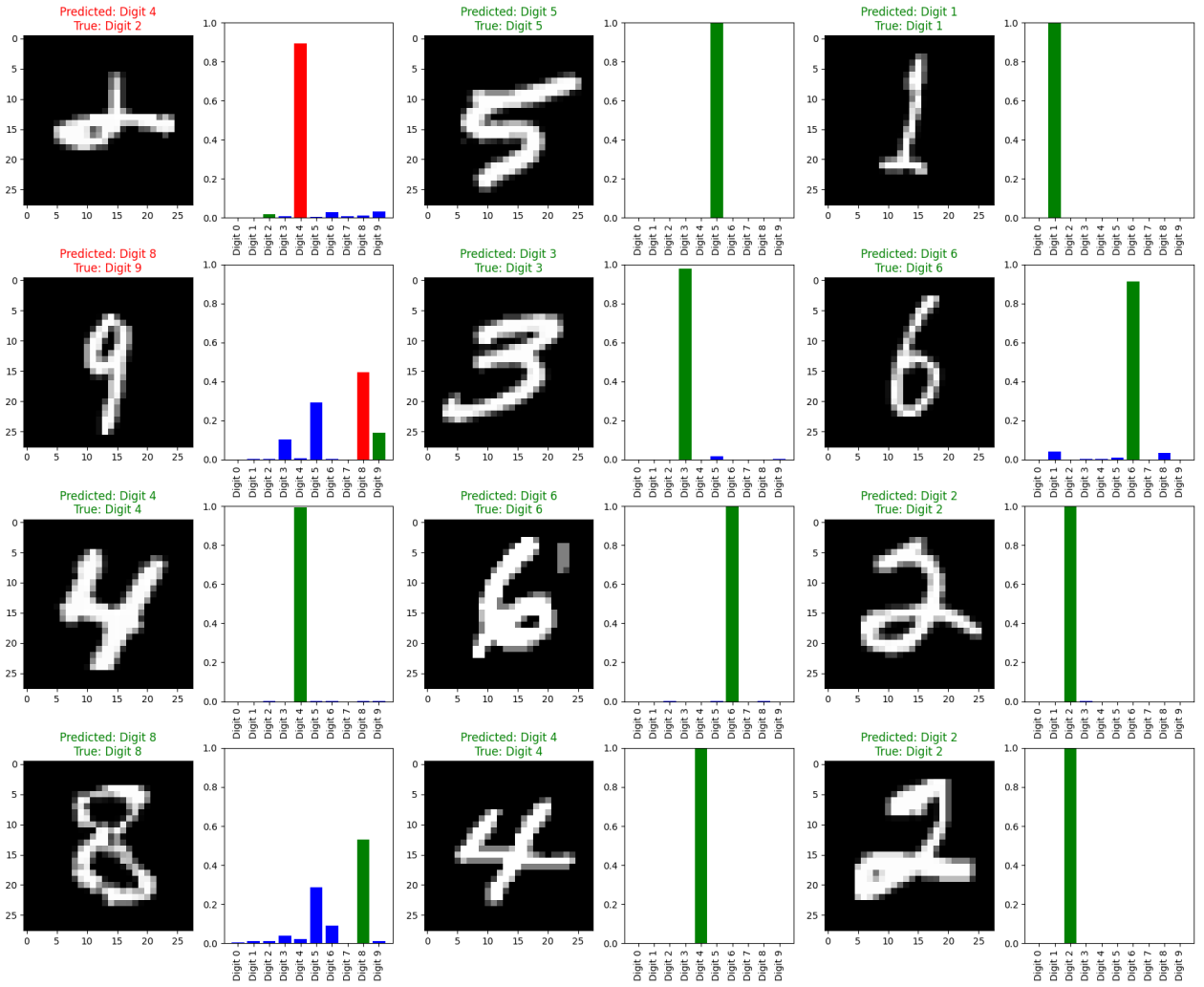
Layer (type)	Output Shape	Param #
flatten_6 (Flatten)	(None, 2352)	0
dense_18 (Dense)	(None, 128)	301,184
dense_19 (Dense)	(None, 64)	8,256
dense_20 (Dense)	(None, 10)	650

Total params: 930,272 (3.55 MB)
Trainable params: 310,090 (1.18 MB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 620,182 (2.37 MB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9733	0.9466	0.9598	693
Digit 1	0.9675	0.9698	0.9687	829
Digit 2	0.9223	0.8859	0.9037	710
Digit 3	0.8381	0.9106	0.8729	671
Digit 4	0.9296	0.9269	0.9283	684
Digit 5	0.8844	0.9045	0.8944	660
Digit 6	0.9484	0.9444	0.9464	701
Digit 7	0.9373	0.9203	0.9287	715
Digit 8	0.8162	0.9320	0.8703	691
Digit 9	0.9413	0.7896	0.8588	670
micro avg	0.9146	0.9146	0.9146	7024
macro avg	0.9159	0.9131	0.9132	7024
weighted avg	0.9173	0.9146	0.9147	7024
samples avg	0.9146	0.9146	0.9146	7024

trial_6

- *Start Time:* 2025-03-12 15:33:32
- *Duration:* 11.375
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	32
units2	64
learning_rate	0.005683132937340711

Evaluation Metrics:

	train	val	test
accuracy	0.9788	0.9769	0.9789
precision	0.9193	0.9125	0.9208
recall	0.8711	0.8624	0.8679
f1	0.8945	0.8867	0.8936

Figures:

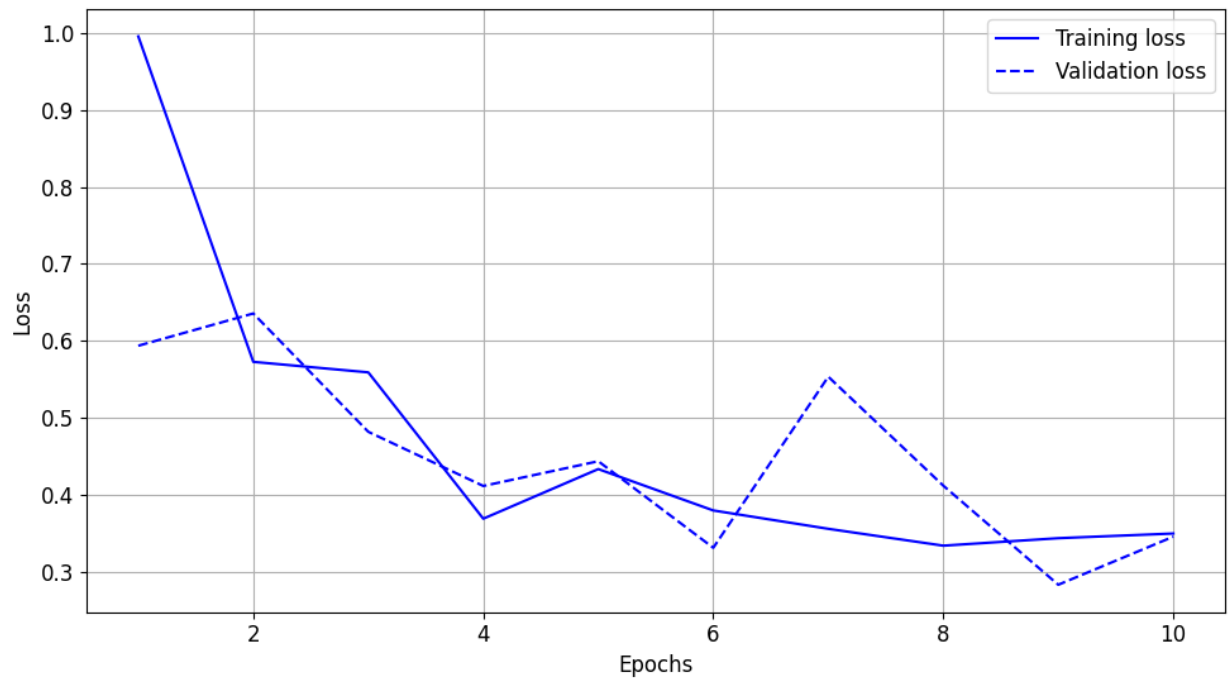
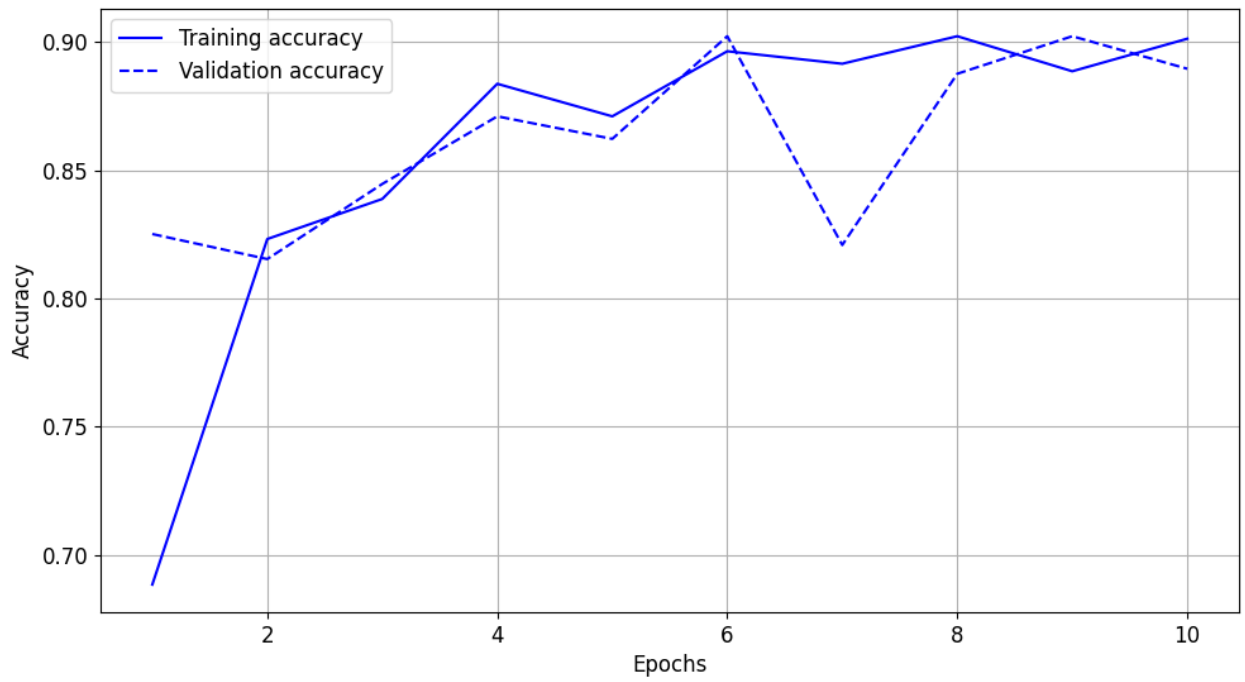
Model Summary

Model: "sequential_5"

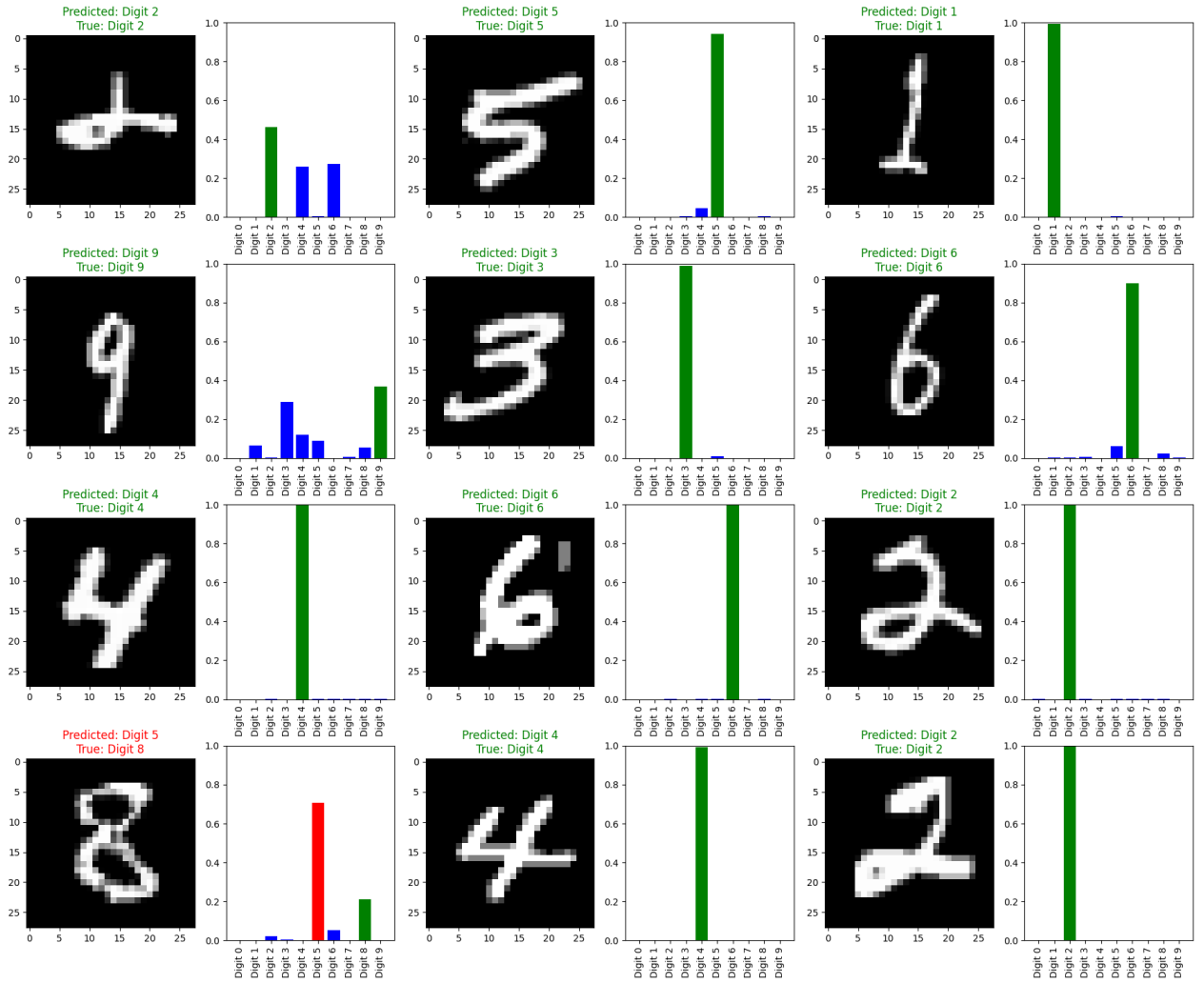
Layer (type)	Output Shape	Param #
flatten_5 (Flatten)	(None, 2352)	0
dense_15 (Dense)	(None, 32)	75,296
dense_16 (Dense)	(None, 64)	2,112
dense_17 (Dense)	(None, 10)	650

Total params: 234,176 (914.75 KB)
Trainable params: 78,058 (304.91 KB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 156,118 (609.84 KB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9692	0.9538	0.9615	693
Digit 1	0.9368	0.9650	0.9507	829
Digit 2	0.8921	0.9085	0.9002	710
Digit 3	0.8843	0.8882	0.8862	671
Digit 4	0.8953	0.9123	0.9037	684
Digit 5	0.6970	0.9409	0.8008	660
Digit 6	0.9358	0.9572	0.9464	701
Digit 7	0.9205	0.9552	0.9375	715
Digit 8	0.9404	0.7077	0.8076	691
Digit 9	0.9427	0.7373	0.8275	670
micro avg	0.8946	0.8946	0.8946	7024
macro avg	0.9014	0.8926	0.8922	7024
weighted avg	0.9030	0.8946	0.8942	7024
samples avg	0.8946	0.8946	0.8946	7024

trial_3

- *Start Time:* 2025-03-12 15:32:55
- *Duration:* 12.401
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	128
units2	128
learning_rate	0.013392061506961936

Evaluation Metrics:

	train	val	test
accuracy	0.9790	0.9769	0.9785
precision	0.9326	0.9278	0.9322
recall	0.8639	0.8515	0.8609
f1	0.8969	0.8880	0.8951

Figures:

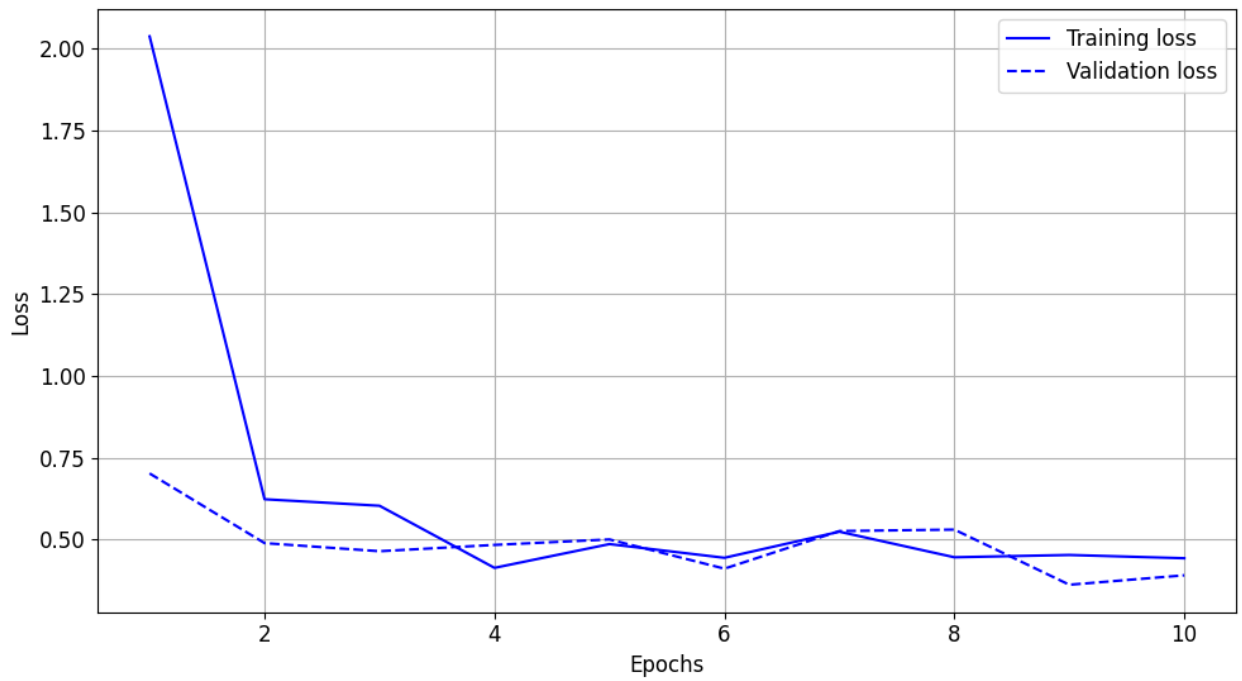
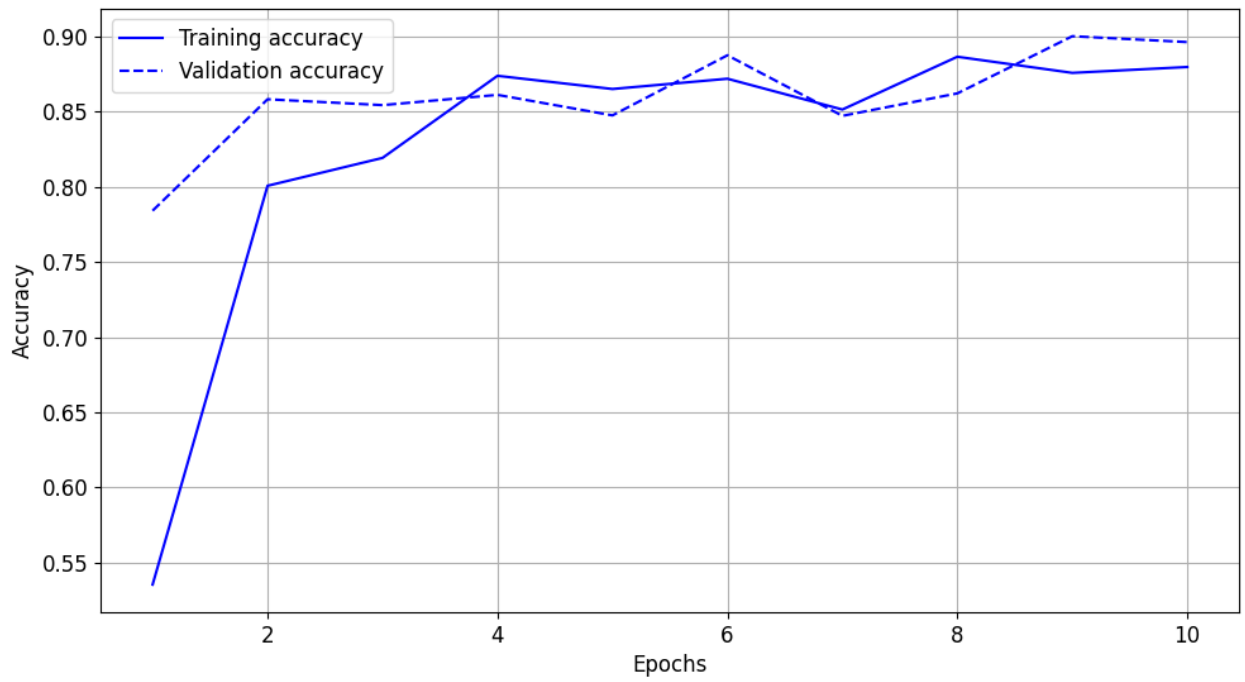
Model Summary

Model: "sequential_2"

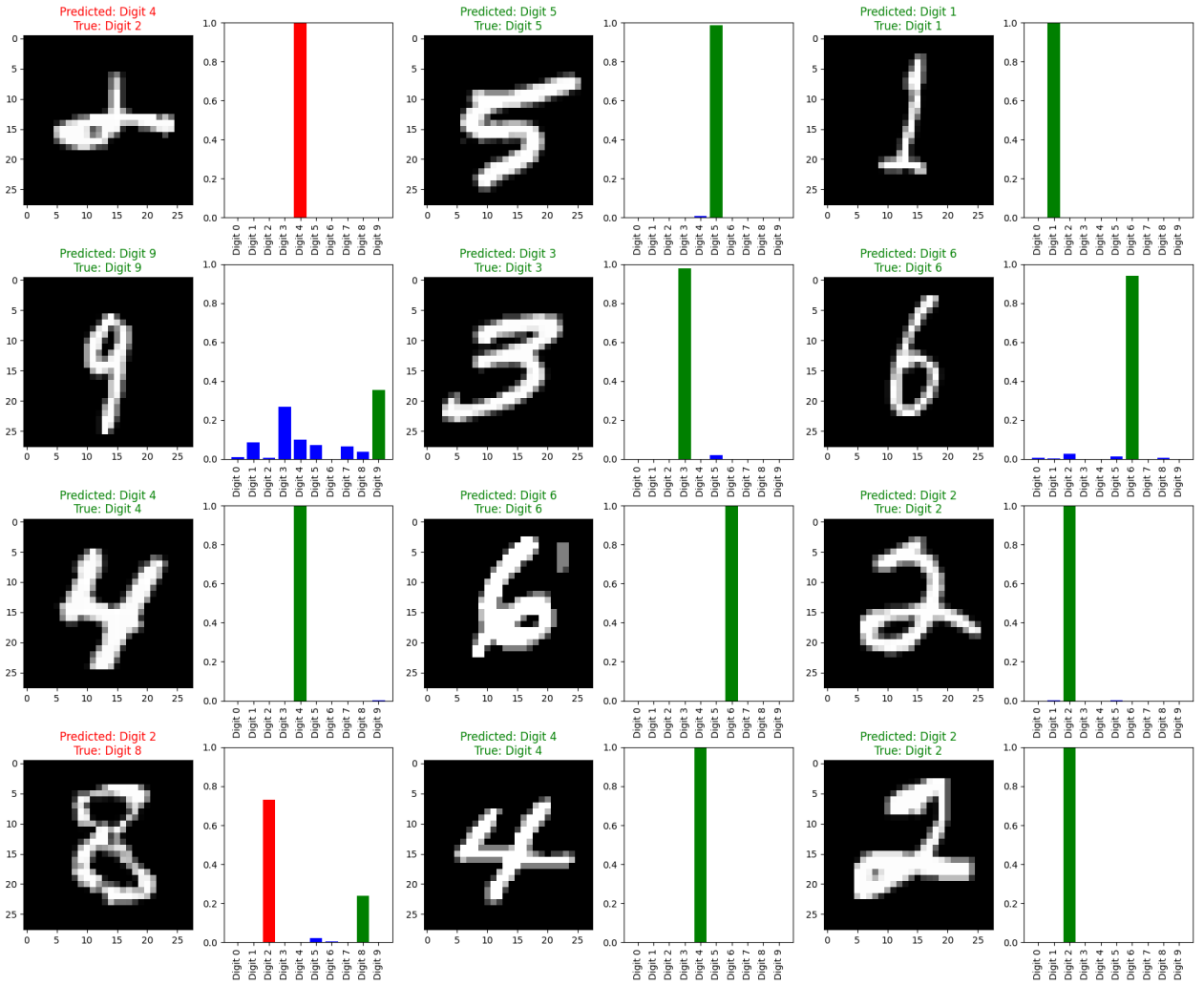
Layer (type)	Output Shape	Param #
flatten_2 (Flatten)	(None, 2352)	0
dense_6 (Dense)	(None, 128)	301,184
dense_7 (Dense)	(None, 128)	16,512
dense_8 (Dense)	(None, 10)	1,290

Total params: 956,960 (3.65 MB)
Trainable params: 318,986 (1.22 MB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 637,974 (2.43 MB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9233	0.9726	0.9473	693
Digit 1	0.9714	0.9409	0.9559	829
Digit 2	0.8537	0.9042	0.8782	710
Digit 3	0.8413	0.8614	0.8513	671
Digit 4	0.8775	0.9108	0.8938	684
Digit 5	0.8142	0.8833	0.8474	660
Digit 6	0.9616	0.8930	0.9260	701
Digit 7	0.9138	0.9343	0.9239	715
Digit 8	0.8710	0.9088	0.8895	691
Digit 9	0.8929	0.6970	0.7829	670
micro avg	0.8925	0.8925	0.8925	7024
macro avg	0.8921	0.8906	0.8896	7024
weighted avg	0.8942	0.8925	0.8917	7024
samples avg	0.8925	0.8925	0.8925	7024

trial_8

- *Start Time:* 2025-03-12 15:33:57
- *Duration:* 12.213
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	128
units2	64
learning_rate	0.028500260400307252

Evaluation Metrics:

	train	val	test
accuracy	0.9777	0.9767	0.9767
precision	0.9289	0.9240	0.9265
recall	0.8528	0.8458	0.8494
f1	0.8892	0.8832	0.8863

Figures:

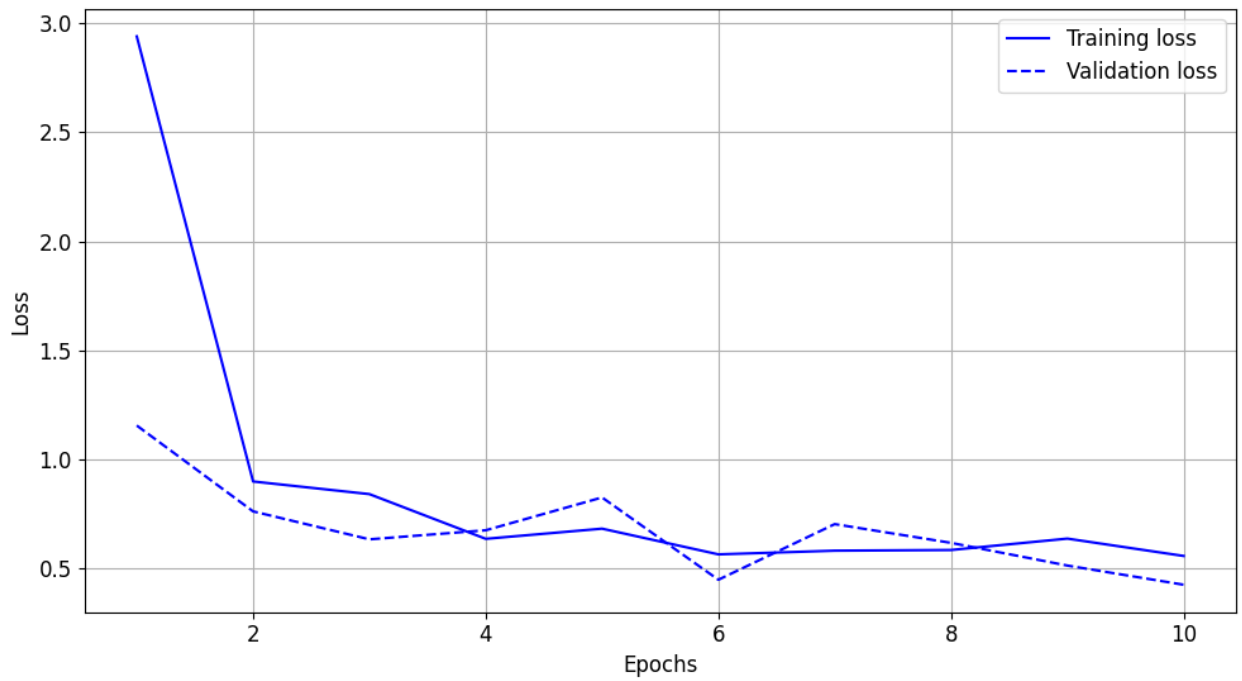
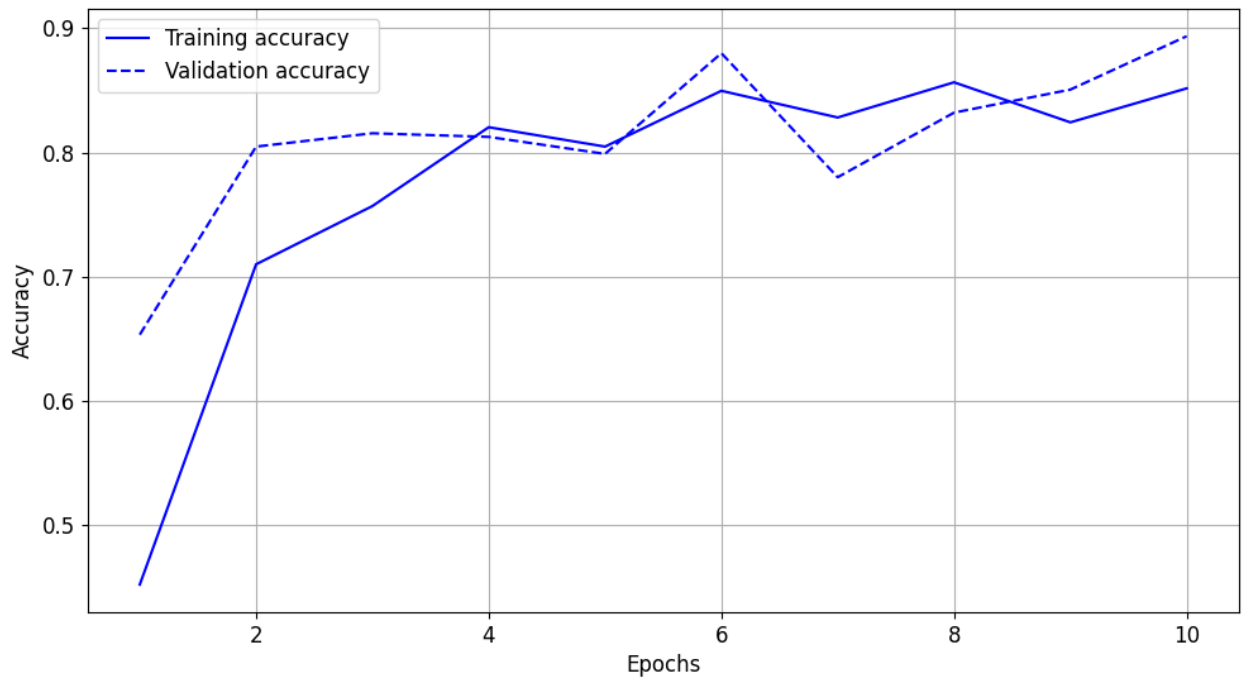
Model Summary

Model: "sequential_7"

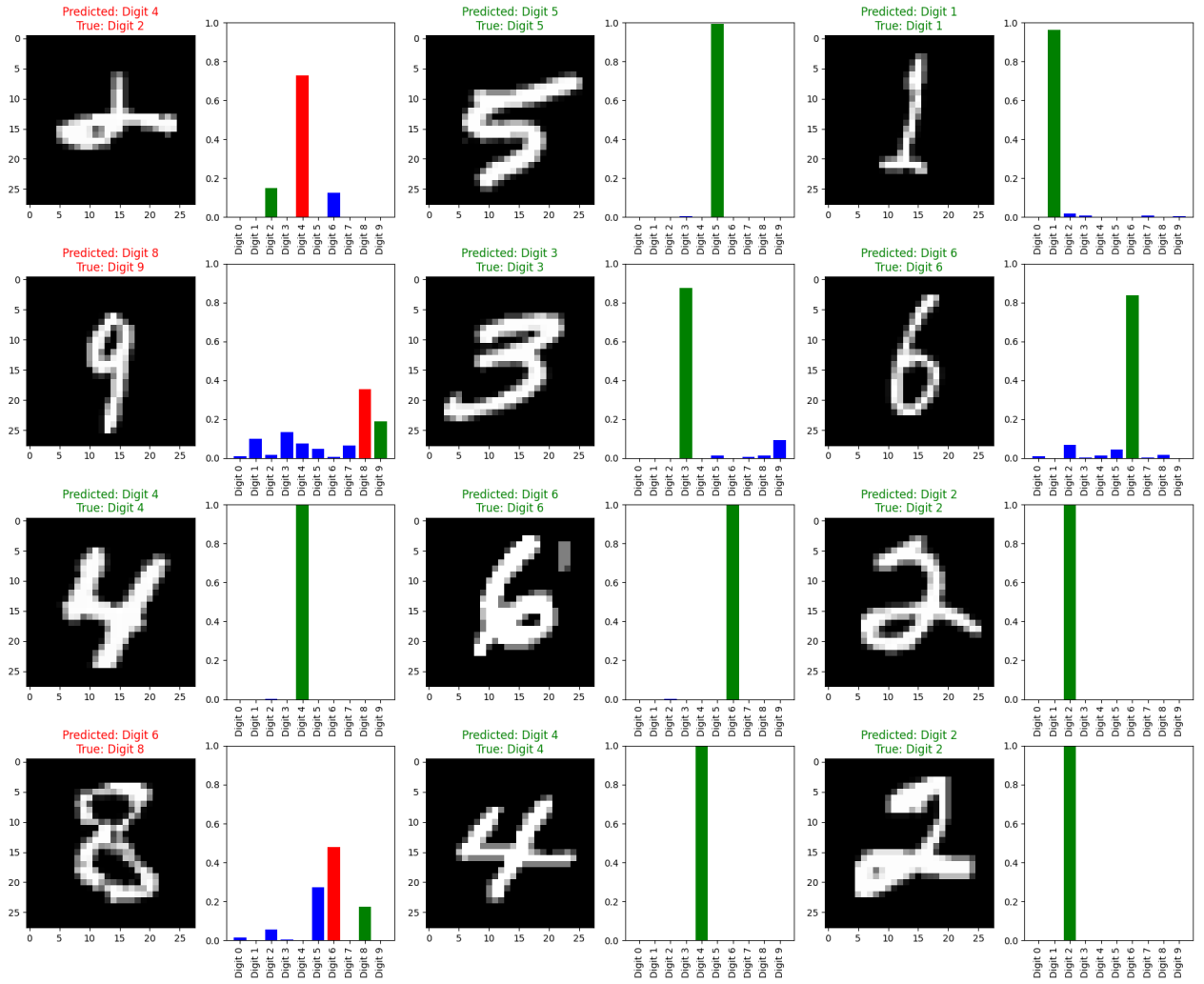
Layer (type)	Output Shape	Param #
flatten_7 (Flatten)	(None, 2352)	0
dense_21 (Dense)	(None, 128)	301,184
dense_22 (Dense)	(None, 64)	8,256
dense_23 (Dense)	(None, 10)	650

Total params: 930,272 (3.55 MB)
Trainable params: 310,090 (1.18 MB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 620,182 (2.37 MB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9713	0.9278	0.9491	693
Digit 1	0.9690	0.9421	0.9554	829
Digit 2	0.9118	0.8296	0.8687	710
Digit 3	0.8680	0.8525	0.8602	671
Digit 4	0.9362	0.8363	0.8834	684
Digit 5	0.8663	0.7758	0.8185	660
Digit 6	0.8418	0.9715	0.9020	701
Digit 7	0.9502	0.9077	0.9285	715
Digit 8	0.7560	0.9103	0.8260	691
Digit 9	0.7986	0.8642	0.8301	670
micro avg	0.8837	0.8837	0.8837	7024
macro avg	0.8869	0.8818	0.8822	7024
weighted avg	0.8891	0.8837	0.8843	7024
samples avg	0.8837	0.8837	0.8837	7024

trial_5

- *Start Time:* 2025-03-12 15:33:20
- *Duration:* 10.425
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	32
units2	64
learning_rate	0.025006331188302998

Evaluation Metrics:

	train	val	test
accuracy	0.9736	0.9725	0.9753
precision	0.9102	0.9077	0.9180
recall	0.8303	0.8287	0.8366
f1	0.8684	0.8664	0.8754

Figures:

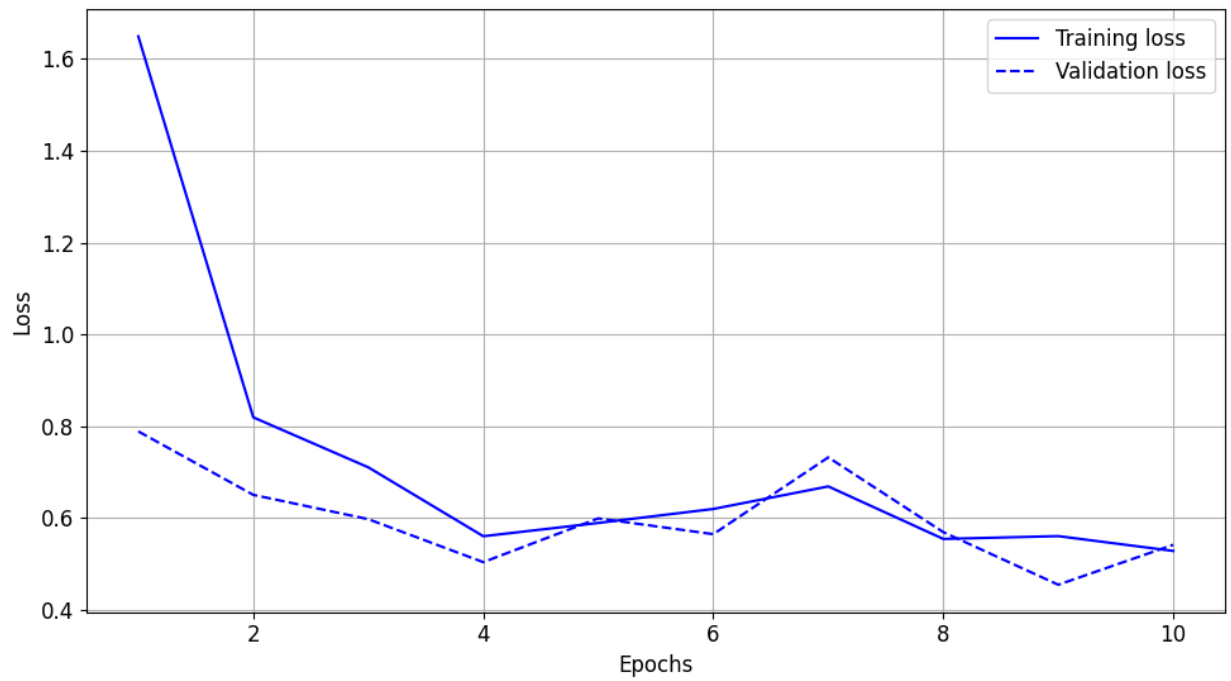
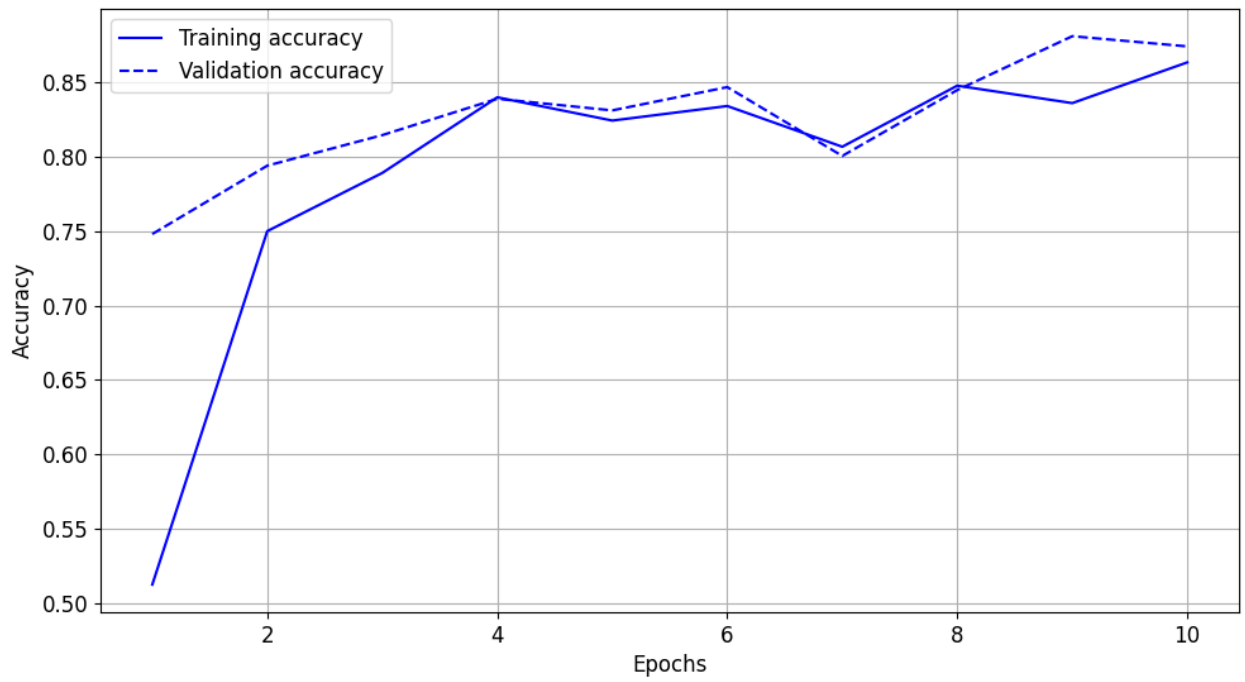
Model Summary

Model: "sequential_4"

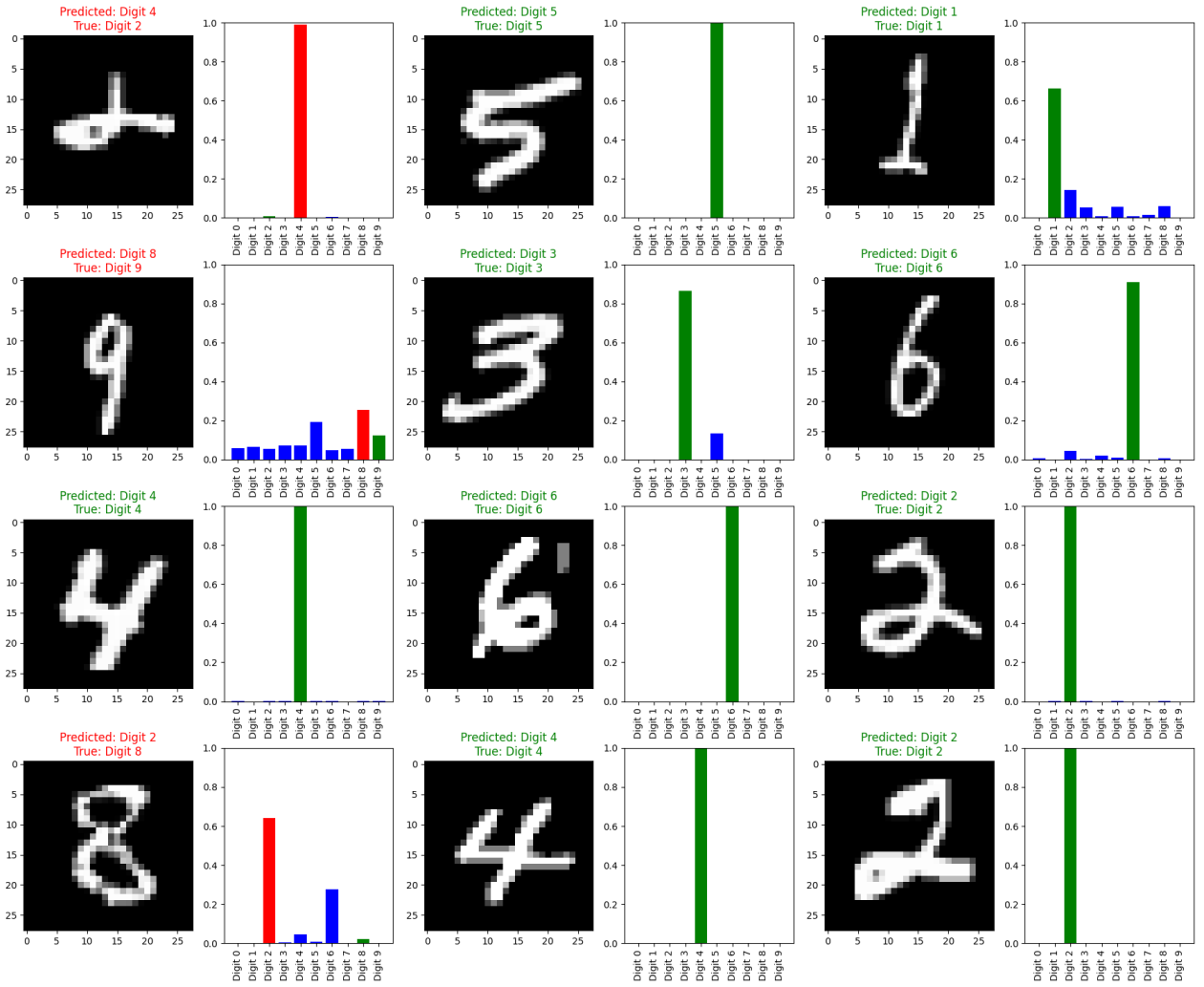
Layer (type)	Output Shape	Param #
flatten_4 (Flatten)	(None, 2352)	0
dense_12 (Dense)	(None, 32)	75,296
dense_13 (Dense)	(None, 64)	2,112
dense_14 (Dense)	(None, 10)	650

Total params: 234,176 (914.75 KB)
Trainable params: 78,058 (304.91 KB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 156,118 (609.84 KB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9498	0.9553	0.9525	693
Digit 1	0.9774	0.9385	0.9575	829
Digit 2	0.8013	0.8972	0.8465	710
Digit 3	0.9067	0.7824	0.8400	671
Digit 4	0.9012	0.8801	0.8905	684
Digit 5	0.7680	0.8076	0.7873	660
Digit 6	0.9152	0.9544	0.9344	701
Digit 7	0.9065	0.8951	0.9008	715
Digit 8	0.7503	0.8784	0.8093	691
Digit 9	0.9144	0.7493	0.8236	670
micro avg	0.8763	0.8763	0.8763	7024
macro avg	0.8791	0.8738	0.8742	7024
weighted avg	0.8812	0.8763	0.8766	7024
samples avg	0.8763	0.8763	0.8763	7024

trial_4

- *Start Time:* 2025-03-12 15:33:08
- *Duration:* 11.280
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	64
units2	128
learning_rate	0.024798126957179527

Evaluation Metrics:

	train	val	test
accuracy	0.9653	0.9650	0.9649
precision	0.8834	0.8834	0.8832
recall	0.7521	0.7497	0.7526
f1	0.8125	0.8111	0.8127

Figures:

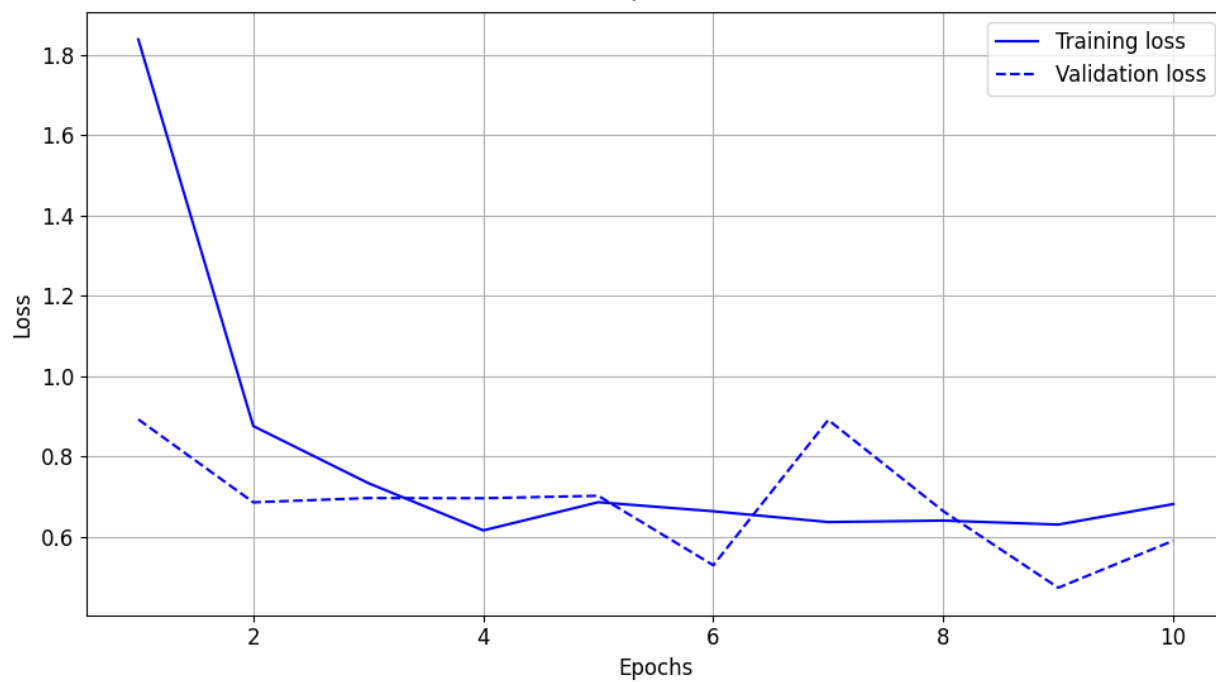
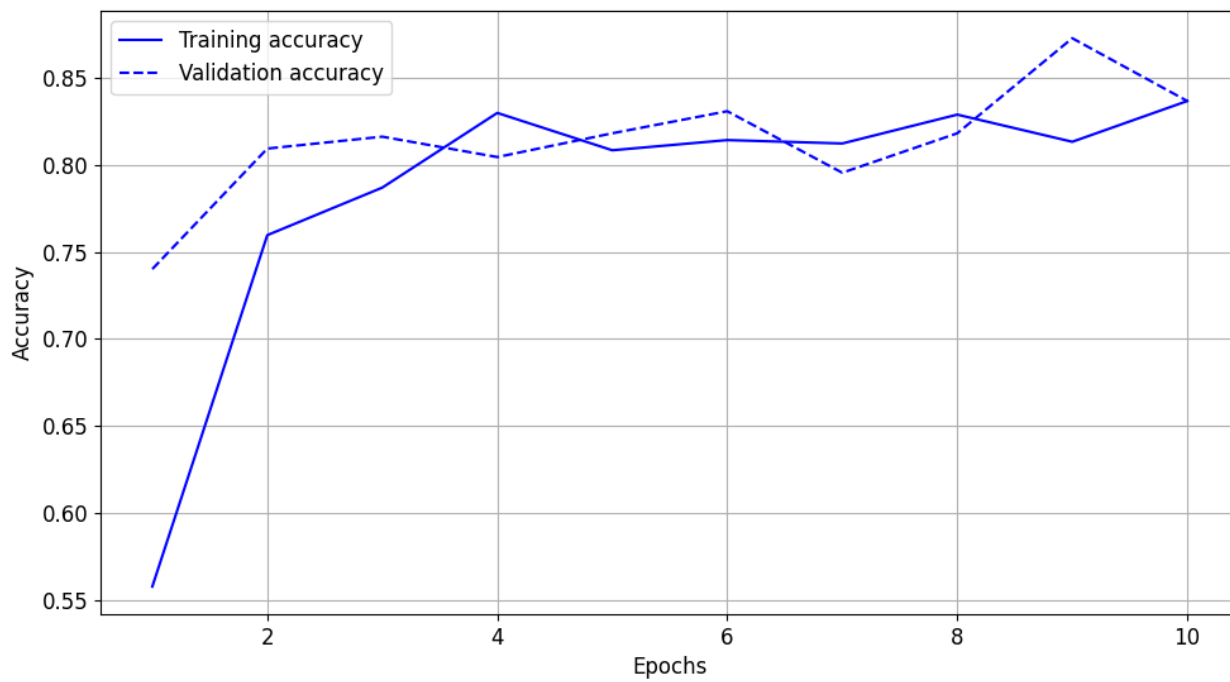
Model Summary

Model: "sequential_3"

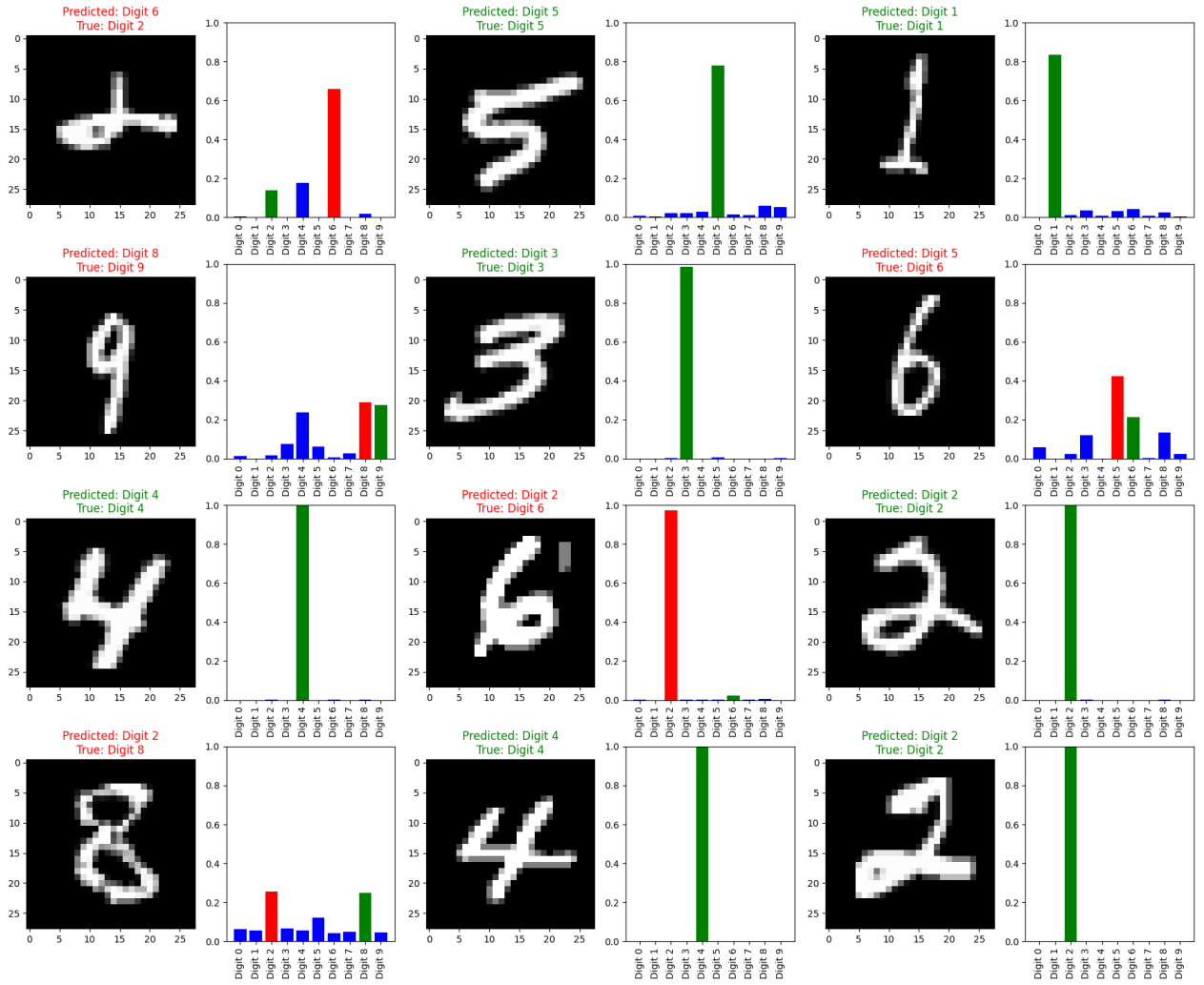
Layer (type)	Output Shape	Param #
flatten_3 (Flatten)	(None, 2352)	0
dense_9 (Dense)	(None, 64)	150,592
dense_10 (Dense)	(None, 128)	8,320
dense_11 (Dense)	(None, 10)	1,290

Total params: 480,608 (1.83 MB)
Trainable params: 160,202 (625.79 KB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 320,406 (1.22 MB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.9203	0.9668	0.9430	693
Digit 1	0.9722	0.8444	0.9038	829
Digit 2	0.7120	0.8324	0.7675	710
Digit 3	0.7693	0.8897	0.8252	671
Digit 4	0.8777	0.8918	0.8847	684
Digit 5	0.9010	0.5379	0.6736	660
Digit 6	0.9528	0.8060	0.8733	701
Digit 7	0.8344	0.8881	0.8604	715
Digit 8	0.5977	0.9204	0.7248	691
Digit 9	0.9309	0.6433	0.7608	670
micro avg	0.8243	0.8243	0.8243	7024
macro avg	0.8468	0.8221	0.8217	7024
weighted avg	0.8488	0.8243	0.8242	7024
samples avg	0.8243	0.8243	0.8243	7024

trial_2

- *Start Time:* 2025-03-12 15:32:42
- *Duration:* 11.619
- *Directory:* [Link](#)

Hyperparameters:

Hyperparameter	Value
units1	32
units2	128
learning_rate	0.035748049504503

Evaluation Metrics:

	train	val	test
accuracy	0.8899	0.8896	0.8910
precision	0.6949	0.6993	0.6990
recall	0.2620	0.2633	0.2681
f1	0.3805	0.3826	0.3875

Figures:

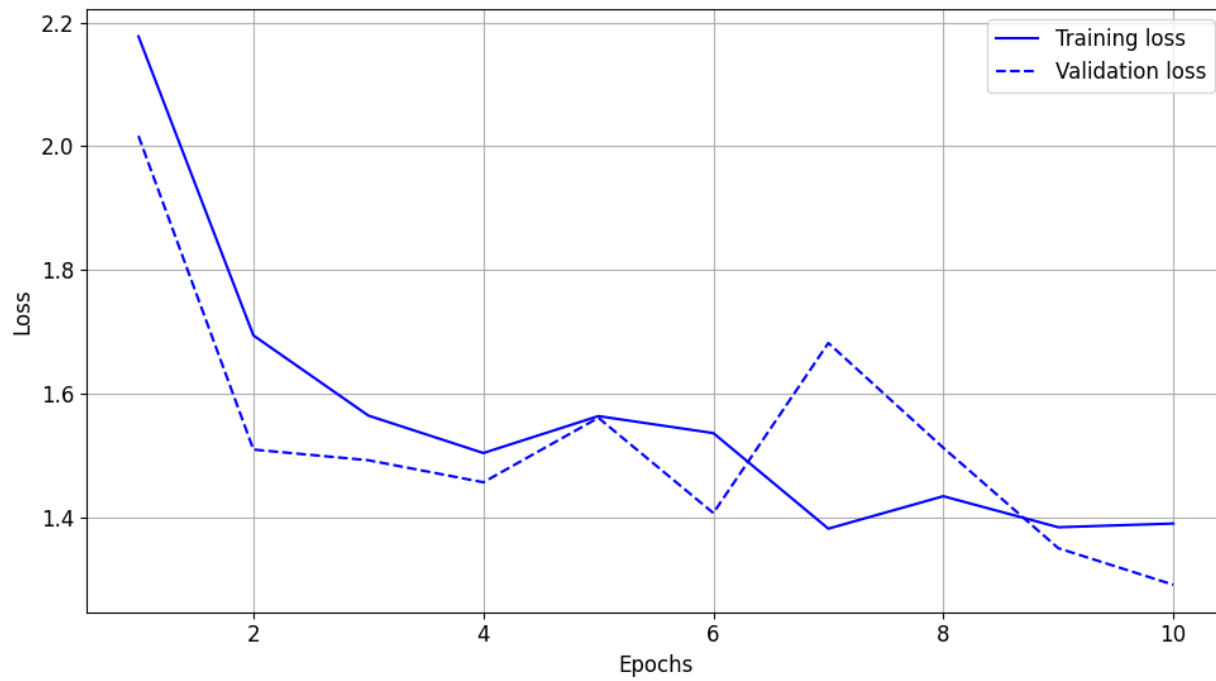
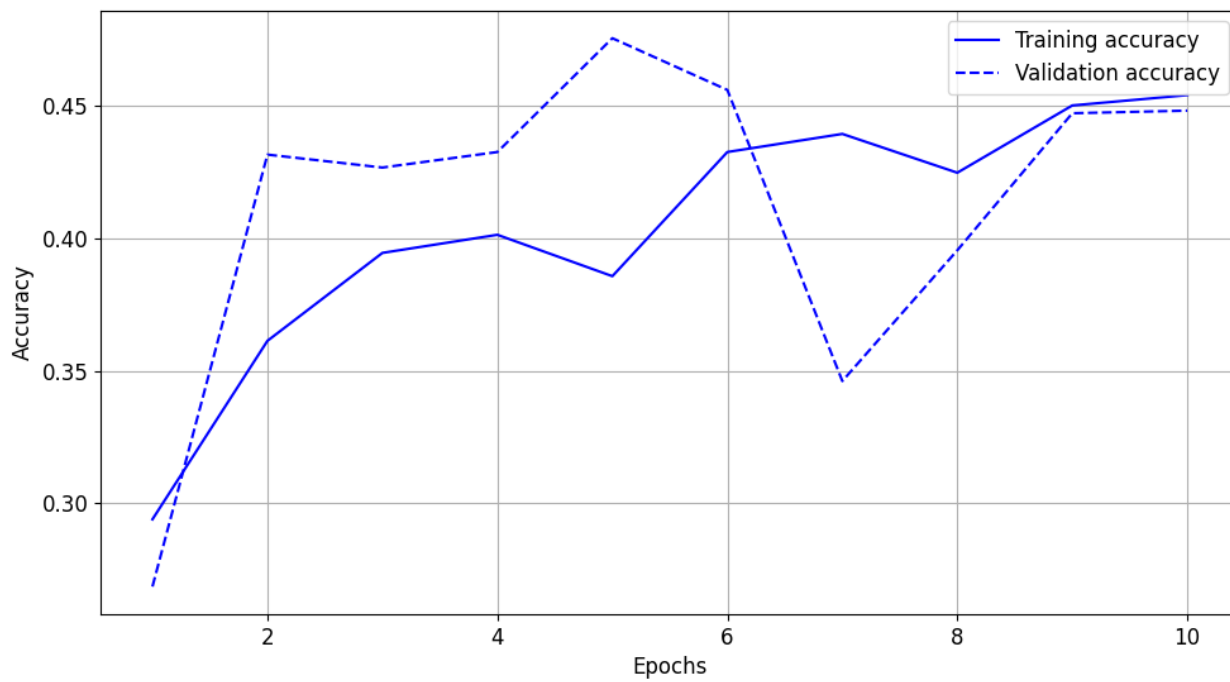
Model Summary

Model: "sequential_1"

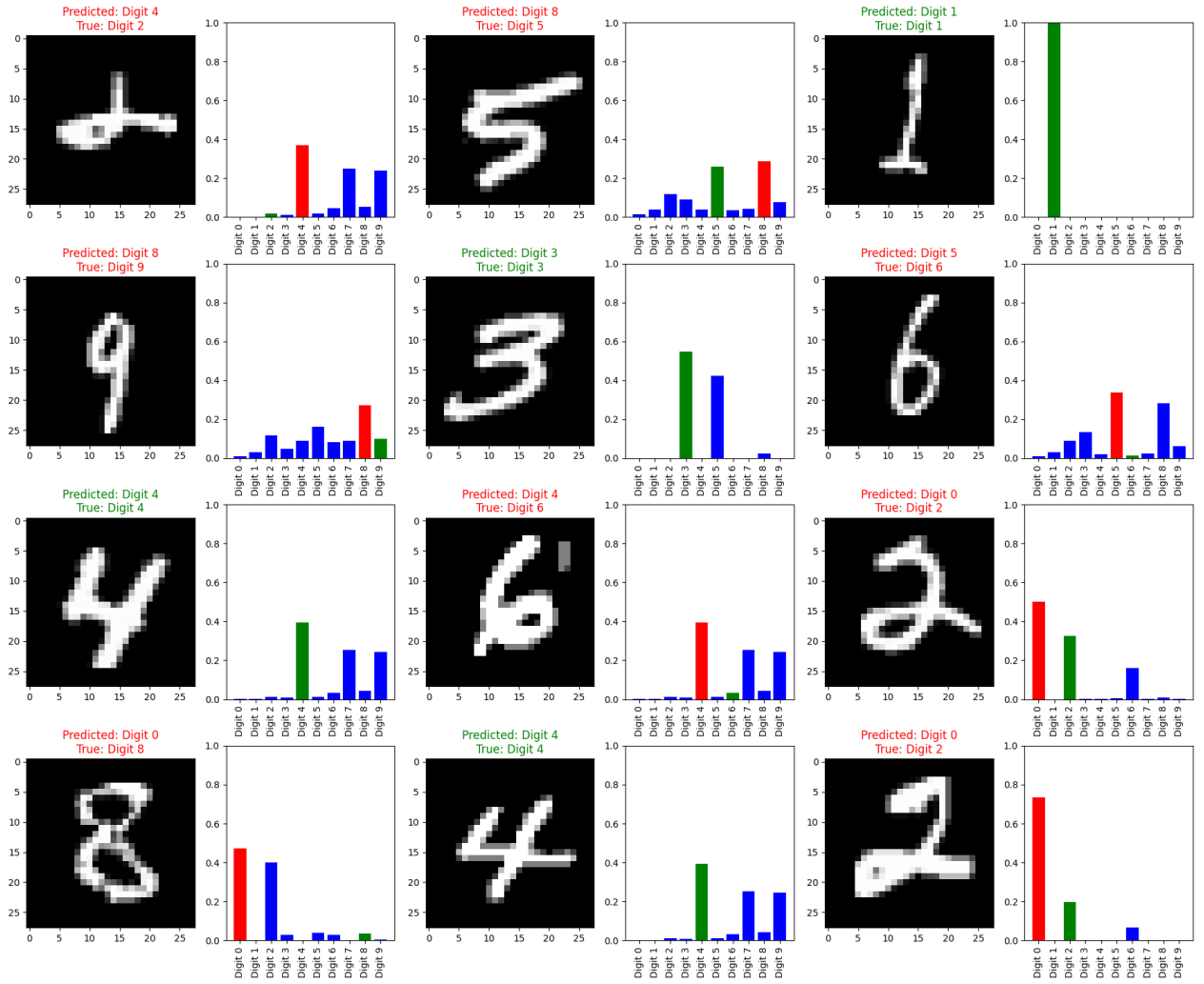
Layer (type)	Output Shape	Param #
flatten_1 (Flatten)	(None, 2352)	0
dense_3 (Dense)	(None, 32)	75,296
dense_4 (Dense)	(None, 128)	4,224
dense_5 (Dense)	(None, 10)	1,290

Total params: 242,432 (947.00 KB)
Trainable params: 80,810 (315.66 KB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 161,622 (631.34 KB)

Training History



Results



Detailed Report of Test Set:

	precision	recall	f1-score	support
Digit 0	0.5348	0.9091	0.6734	693
Digit 1	0.9643	0.9445	0.9543	829
Digit 2	0.2744	0.2577	0.2658	710
Digit 3	0.5693	0.7288	0.6392	671
Digit 4	0.2935	0.9225	0.4453	684
Digit 5	0.2939	0.3500	0.3195	660
Digit 6	0.5000	0.2183	0.3039	701
Digit 7	0.0000e+00	0.0000e+00	0.0000e+00	715
Digit 8	0.3608	0.1331	0.1945	691
Digit 9	0.3636	0.0060	0.0117	670
micro avg	0.4550	0.4550	0.4550	7024
macro avg	0.4155	0.4470	0.3808	7024
weighted avg	0.4250	0.4550	0.3910	7024
samples avg	0.4550	0.4550	0.4550	7024