UPDATED ANALYSIS ON 2D CNN ARCHITECTURE MODEL ON BRAIN TUMOR CLASSIFICATION

1) Activation Function ReLu:

Kernel Size	3x3
No. Of Kernels	1st Layer: 32 Kernels 2nd Layer: 64 Kernels 3rd Layer: 128 Kernels
Activation Function	ReLu
Dropout Layers	No Dropout Layers
FCs Layer	1 Fully Connect Layers Dense (128, activation = ReLU)
Regularization	No regularization
Max Pooling	First Max Pooling: (2x2) Second Max Pooling: (2x2) Third Max Pooling: (2x2)
No. of Control Layers	No Specific Control Layers

- Result and Observation:

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
1	0.4225	1.3662	0.6112	1.0262
2	0.6775	0.8042	0.7070	0.7986
3	0.7149	0.7031	0.6889	0.7984
4	0.7377	0.6444	0.6426	1.0037
5	0.7562	0.6068	0.6905	0.8054
6	0.7720	0.5701	0.7408	0.6797
7	0.7719	0.5706	0.7172	0.7343
8	0.8057	0.4955	0.7926	0.5415
9	0.7951	0.5069	0.7863	0.5387
10	0.8153	0.4807	0.8115	0.4872
11	0.8238	0.4384	0.8146	0.4930
12	0.8254	0.4424	0.7636	0.6087
13	0.8325	0.4185	0.8335	0.4375
14	0.8465	0.4092	0.7510	0.6673
15	0.8561	0.3853	0.8060	0.5424
16	0.8477	0.3920	0.8421	0.4248
17	0.8565	0.3835	0.8358	0.4533
18	0.8680	0.3441	0.8335	0.4332

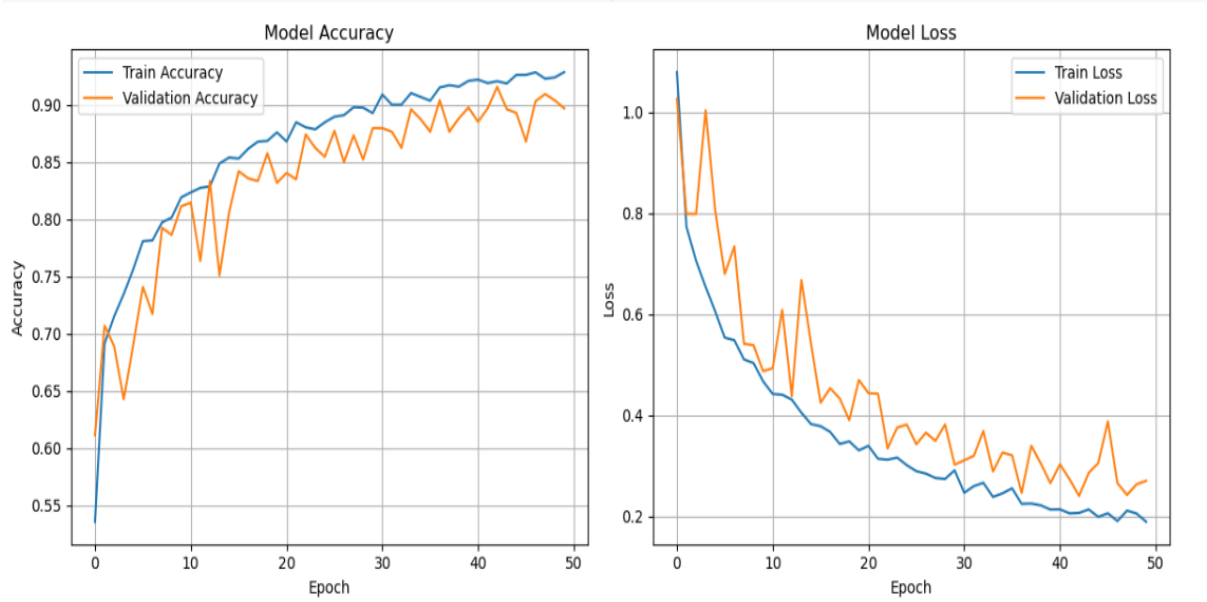
Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
19	0.8754	0.3395	0.8578	0.3902
20	0.8800	0.3241	0.8319	0.4698
21	0.8703	0.3260	0.8405	0.4436
22	0.8796	0.3247	0.8350	0.4424
23	0.8868	0.3045	0.8743	0.3341
24	0.8760	0.3239	0.8625	0.3754
25	0.8906	0.2958	0.8547	0.3815
26	0.8827	0.2967	0.8775	0.3425
27	0.8936	0.2792	0.8500	0.3653
28	0.8917	0.2967	0.8735	0.3492
29	0.9019	0.2669	0.8523	0.3816
30	0.8974	0.2810	0.8798	0.3021
31	0.9139	0.2275	0.8798	0.3108
32	0.8999	0.2506	0.8767	0.3195
33	0.8976	0.2703	0.8625	0.3687
34	0.9082	0.2552	0.8963	0.2886
35	0.9044	0.2461	0.8877	0.3259
36	0.8982	0.2629	0.8767	0.3205
37	0.9072	0.2346	0.9042	0.2462

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
38	0.9111	0.2333	0.8767	0.3396
39	0.9147	0.2329	0.8885	0.3044
40	0.9225	0.2071	0.8979	0.2655
41	0.9239	0.2042	0.8853	0.3029
42	0.9222	0.2098	0.8971	0.2731
43	***0.9255***	***0.1962***	***0.9159***	***0.2400***
44	0.9149	0.2280	0.8963	0.2859
45	0.9314	0.1852	0.8932	0.3050
46	0.9250	0.2039	0.8680	0.3879
47	0.9310	0.1891	0.9034	0.2654
48	0.9224	0.2107	0.9097	0.2420
49	0.9302	0.1820	0.9011	0.2966
50	0.9308	0.1764	0.9113	0.2784

Test Accuracy: 0.9159

Test Loss: 0.2400

- Graph:



2) Activation Function Sigmoid:

Kernel Size	3x3
No. Of Kernels	1st Layer: 32 Kernels 2nd Layer: 64 Kernels 3rd Layer: 128 Kernels
Activation Function	Sigmoid
Dropout Layers	No Dropout Layers
FCs Layer	1 Fully Connect Layers Dense (128, activation = ReLU)
Regularization	No regularization
Max Pooling	First Max Pooling: (2x2) Second Max Pooling: (2x2) Third Max Pooling: (2x2)
No. of Control Layers	No Specific Control Layers

- Result and Observation:

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
1	0.2812	1.3977	0.6826	0.8114
2	0.6838	0.7801	0.6858	0.7955
3	0.7228	0.6972	0.7628	0.6026
4	0.7499	0.6197	0.7211	0.7256
5	0.7611	0.5833	0.7573	0.6239
6	0.7808	0.5466	0.7659	0.6175
7	0.8134	0.4933	0.7062	0.7591
8	0.8057	0.4862	0.7753	0.5646
9	0.8262	0.4605	0.8130	0.4775
10	0.8068	0.4750	0.8020	0.4789
11	0.8412	0.3994	0.8170	0.4445
12	0.8289	0.4206	0.8201	0.4327
13	0.8527	0.3840	0.8107	0.4479
14	0.8454	0.3906	0.8052	0.4751
15	0.8574	0.3612	0.8350	0.3939
16	0.8683	0.3479	0.8099	0.4821
17	0.8638	0.3576	0.8476	0.3724
18	0.8770	0.3386	0.8013	0.5104

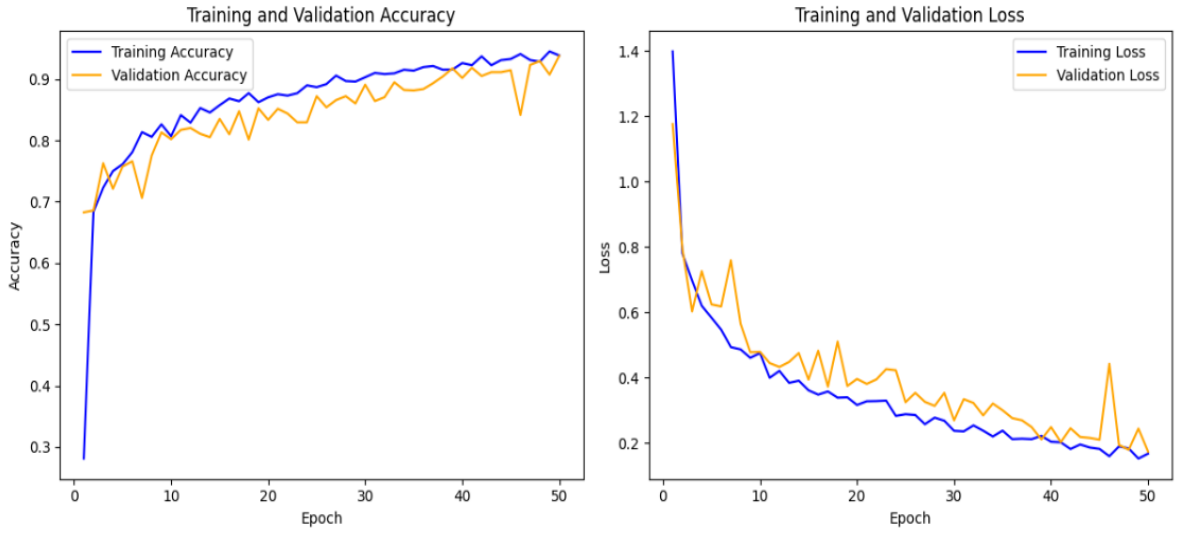
Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
19	0.8622	0.3397	0.8523	0.3745
20	0.8701	0.3163	0.8335	0.3959
21	0.8752	0.3276	0.8515	0.3808
22	0.8729	0.3282	0.8437	0.3945
23	0.8769	0.3296	0.8295	0.4259
24	0.8898	0.2830	0.8295	0.4224
25	0.8868	0.2880	0.8720	0.3247
26	0.8917	0.2857	0.8539	0.3533
27	0.9056	0.2574	0.8657	0.3258
28	0.8967	0.2777	0.8720	0.3135
29	0.8958	0.2679	0.8602	0.3532
30	0.9029	0.2372	0.8908	0.2691
31	0.9100	0.2355	0.8641	0.3341
32	0.9081	0.2537	0.8704	0.3224
33	0.9093	0.2376	0.8947	0.2844
34	0.9152	0.2200	0.8822	0.3207
35	0.9137	0.2378	0.8814	0.3000
36	0.9195	0.2118	0.8837	0.2761
37	0.9213	0.2131	0.8932	0.2693

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
38	0.9152	0.2117	0.9042	0.2485
39	0.9155	0.2218	0.9175	0.2109
40	0.9260	0.2038	0.9018	0.2486
41	0.9226	0.2021	0.9183	0.2026
42	0.9370	0.1816	0.9049	0.2449
43	0.9225	0.1954	0.9112	0.2185
44	0.9308	0.1860	0.9112	0.2155
45	0.9327	0.1818	0.9144	0.2100
46	0.9408	0.1595	0.8413	0.4423
47	0.9310	0.1895	0.9230	0.1940
48	0.9283	0.1834	0.9293	0.1792
49	0.9450	0.1524	0.9073	0.2441
50	***0.9384***	***0.1675***	***0.9379***	***0.1733***

Test Accuracy: 0.9379

Test Loss: 0.1733

- Graph:



3) Activation Function Sigmoid with Regularization:

Kernel Size	3x3
No. Of Kernels	1st Layer: 32 Kernels 2nd Layer: 64 Kernels 3rd Layer: 128 Kernels
Activation Function	Sigmoid
Dropout Layers	No Dropout Layers
FCs Layer	1 Fully Connect Layers Dense (128, activation = ReLU)
Regularization	Elastic L1 and L2 Regularization
Max Pooling	First Max Pooling: (2x2) Second Max Pooling: (2x2) Third Max Pooling: (2x2)
No. of Control Layers	No Specific Control Layers

- Result and Observation:

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
1	0.2812	6.2118	0.3936	1.7354
2	0.6300	1.1895	0.7031	1.1102
3	0.6792	1.0956	0.6489	1.1231
4	0.7175	1.0211	0.6127	1.2063
5	0.7339	0.9856	0.7164	1.0420
6	0.7371	0.9684	0.6591	1.1614
7	0.7357	0.9663	0.6379	1.3315
8	0.7485	0.9235	0.7361	0.9674
9	0.7429	0.9390	0.6968	1.1082
10	0.7530	0.9294	0.6190	1.2719
11	0.7609	0.8956	0.7070	1.0394
12	0.7674	0.9077	0.7392	1.0118
13	0.7790	0.8737	0.7211	1.0149
14	0.7832	0.8649	0.7636	0.8891
15	0.7867	0.8504	0.7376	0.9502
16	0.7624	0.8857	0.7463	0.9931
17	0.7779	0.8596	0.7463	0.9522
18	0.7975	0.8205	0.7706	0.8496

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
19	0.7869	0.8296	0.7431	0.9241
20	0.7986	0.8196	0.7447	0.9073
21	0.8114	0.7987	0.7455	0.9100
22	0.7953	0.8071	0.7714	0.8372
23	0.7981	0.8019	0.7651	0.8921
24	0.7902	0.8133	0.7793	0.8618
25	0.8150	0.7589	0.7620	0.9293
26	0.8121	0.7866	0.7675	0.8565
27	0.8025	0.7903	0.7502	0.9239
28	0.8188	0.7739	0.7863	0.8219
29	0.8154	0.7618	0.7604	0.8490
30	0.8213	0.7446	0.7636	0.9165
31	0.8194	0.7707	0.7855	0.7994
32	0.8352	0.7309	0.7903	0.8399
33	0.8177	0.7482	0.8099	0.7980
34	0.8388	0.7151	0.7793	0.8688
35	0.8318	0.7372	0.8272	0.7598
36	0.8362	0.7403	0.7910	0.8065
37	0.8566	0.6989	0.8225	0.7492

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
38	0.8262	0.7553	0.8060	0.7839
39	0.8502	0.6923	0.7934	0.8336
40	0.8614	0.6721	0.8248	0.7656
41	0.8520	0.7045	0.8185	0.7974
42	0.8493	0.6935	0.8052	0.8234
43	0.8493	0.6884	0.8162	0.7606
44	0.8539	0.6868	0.8288	0.7603
45	0.8498	0.6824	0.8311	0.7855
46	0.8548	0.6765	0.8193	0.8080
47	0.8643	0.6758	0.8178	0.7943
48	0.8610	0.6785	0.8382	0.7532
49	0.8547	0.6896	0.8342	0.7406
50	0.8558	0.6698	0.8460	0.7153
51	0.8577	0.6953	0.7690	0.9391
52	0.8714	0.6550	0.8107	0.8031
53	0.8638	0.6613	0.8437	0.7199
54	0.8814	0.6305	0.8397	0.7182
55	0.8737	0.6349	0.8382	0.7031
56	0.8785	0.6224	0.8437	0.7001

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
57	0.8787	0.6238	0.8460	0.7339
58	0.8716	0.6509	0.8374	0.7039
59	0.8759	0.6173	0.8280	0.7326
60	0.8802	0.6146	0.8515	0.6818
61	0.8799	0.6132	0.8342	0.7492
62	0.8777	0.6235	0.8445	0.7254
63	0.8735	0.6388	0.8374	0.7015
64	0.8763	0.6368	0.8579	0.6650
65	0.8861	0.6137	0.8538	0.6963
66	0.8914	0.5958	0.8545	0.6786
67	0.8829	0.6175	0.8579	0.6974
68	0.8827	0.6090	0.8460	0.7061
69	0.8891	0.6032	0.8587	0.6878
70	0.8896	0.5868	0.8587	0.6836
71	0.8971	0.5696	0.8553	0.6732
72	0.8912	0.5862	0.8538	0.7030
73	0.9004	0.5660	0.8595	0.6760
74	0.8968	0.5702	0.8635	0.6599
75	0.8929	0.5773	0.8568	0.6733

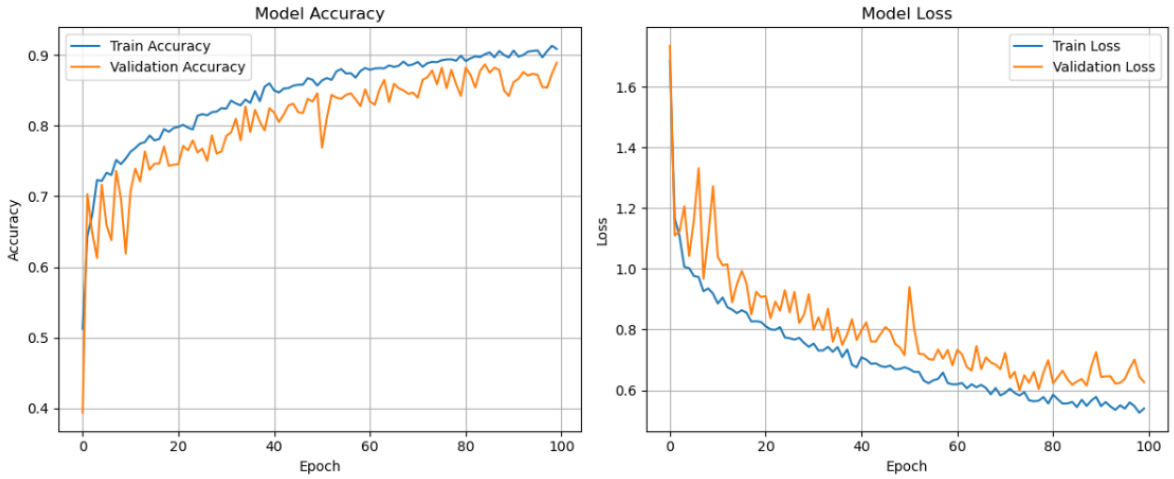
Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
76	0.8993	0.5616	0.8500	0.6990
77	0.8957	0.5661	0.8658	0.6527
78	0.8985	0.5610	0.8643	0.6557
79	0.8966	0.5747	0.8635	0.6634
80	0.9020	0.5592	0.8650	0.6538
81	0.9016	0.5550	0.8643	0.6503
82	0.8960	0.5726	0.8666	0.6566
83	0.9016	0.5516	0.8619	0.6722
84	0.9023	0.5474	0.8635	0.6713
85	0.8991	0.5536	0.8576	0.6846
86	0.9034	0.5483	0.8619	0.6702
87	0.9009	0.5530	0.8627	0.6659
88	0.9004	0.5501	0.8635	0.6667
89	0.9018	0.5546	0.8658	0.6511
90	0.9030	0.5469	0.8627	0.6605
91	0.9071	0.5410	0.8673	0.6442
92	0.9054	0.5367	0.8643	0.6594
93	0.9059	0.5350	0.8689	0.6374
94	0.9036	0.5420	0.8595	0.6706

Epoch	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
95	0.9048	0.5371	0.8643	0.6584
96	0.9041	0.5346	0.8603	0.6668
97	0.9064	0.5324	0.8627	0.6635
98	***0.9059***	***0.5344***	***0.8704***	***0.6455***
99	0.9062	0.5285	0.8673	0.6484
100	0.9096	0.5233	0.8689	0.6415

Test Accuracy: 0.8704

Test Loss: 0.6455

- Graph:



4) Activation Function TanH:

Kernel Size	3x3
No. Of Kernels	1st Layer: 32 Kernels 2nd Layer: 64 Kernels 3rd Layer: 128 Kernels
Activation Function	tanH
Dropout Layers	No Dropout Layers
FCs Layer	1 Fully Connect Layers Dense (128, activation = ReLU)
Regularization	No Regularization
Max Pooling	First Max Pooling: (2x2) Second Max Pooling: (2x2) Third Max Pooling: (2x2)
No. of Control Layers	No Specific Control Layers

- Result and Observation:

Epoch	Accuracy	Loss	Validation Accuracy	Validation Loss
1	0.4516	1.3979	0.6080	1.0818
2	0.6718	0.7967	0.6984	0.7409
3	0.7223	0.7057	0.7117	0.7806
4	0.7212	0.6950	0.7510	0.6356
5	0.7582	0.5858	0.7565	0.6158
6	0.7652	0.5894	0.7353	0.6331
7	0.7918	0.5238	0.7698	0.5340

Epoch	Accuracy	Loss	Validation Accuracy	Validation Loss
8	0.7989	0.5075	0.7800	0.5279
9	0.8186	0.4796	0.7903	0.4725
10	0.8034	0.4886	0.7667	0.6139
11	0.8196	0.4719	0.7690	0.5336
12	0.8226	0.4524	0.7832	0.5398
13	0.8229	0.4516	0.7895	0.4965
14	0.8362	0.4319	0.7965	0.4668
15	0.8368	0.4092	0.8178	0.4504
16	0.8401	0.4097	0.8075	0.4335
17	0.8532	0.3763	0.8397	0.3944
18	0.8618	0.3552	0.7714	0.5948
19	0.8427	0.3958	0.8382	0.3834
20	0.8659	0.3441	0.8327	0.4378
21	0.8705	0.3466	0.8570	0.3523
22	0.8682	0.3539	0.8397	0.3900
23	0.8826	0.3124	0.8665	0.3390
24	0.8822	0.3106	0.8531	0.3563
25	0.8861	0.3069	0.8413	0.3721

Epoch	Accuracy	Loss	Validation Accuracy	Validation Loss
26	0.8828	0.3100	0.8036	0.4903
27	0.8805	0.3151	0.8625	0.3352
28	0.8964	0.2779	0.8892	0.2968
29	0.9032	0.2693	0.8429	0.4343
30	0.8970	0.2637	0.8861	0.2917
31	0.9040	0.2641	0.8625	0.3724
32	0.8986	0.2670	0.8892	0.2968
33	0.9090	0.2436	0.8492	0.3961
34	0.9049	0.2479	0.8515	0.4151
35	0.9050	0.2363	0.8995	0.2583
36	0.9089	0.2382	0.8672	0.3091
37	0.9113	0.2337	0.8507	0.3667
38	0.9281	0.2124	0.8798	0.2997
39	0.9130	0.2293	0.8822	0.2789
40	0.9164	0.2405	0.8916	0.2981
41	0.9196	0.2164	0.8885	0.2653
42	0.9215	0.2211	0.9057	0.2176
43	0.9133	0.2232	0.8798	0.2903

Epoch	Accuracy	Loss	Validation Accuracy	Validation Loss
44	0.9160	0.2139	0.9057	0.2435
45	***0.9343***	***0.1834***	***0.9222***	***0.1881***
46	0.9342	0.1890	0.8908	0.2675
47	0.9281	0.1887	0.9042	0.2406
48	0.9264	0.1932	0.9183	0.1857
49	0.9291	0.1870	0.9207	0.1991
50	0.9271	0.1968	0.9002	0.2524

Test Accuracy: 0.9222

Test Loss:0.1881

- Graph: