

ניסוי מספר	סוגי אקטיבציה	Dropout rate	Learning rate	Number of epochs	Batch size	הערות
1	sigmoid, tanh, relu,	0.3	0.001	10	128	
2	sigmoid, tanh, relu,	0.2	0.001	20	128	
3	Tanh ReLU	0.2	0.0001	20	128	
4	Tanh ReLU	0.2	0.1	20	64	
5	tanh, relu, sigmoid	0.2	0.01	30	64	
6	tanh, relu, sigmoid	0.02	0.01	10	32	
7	tanh, sigmoid	0.0001	0.6	10	128	זאת ההרצה הכי טובה עד כה
8	relu, sigmoid	0.07	0.0001	20	128	
9	relu	0.1	0.2	20	128	
10	relu	0.001	0.1	20	128	
11	relu Tanh	0.001	0.1	20	32	
12	relu Tanh	0.004	0.1	30	64	

13	tanh, relu, sigmoid	0.004	0.1	50	128	
14	tanh, relu, sigmoid	0.03	0.1	25	128	
15	relu,	0.3	0.1	15	128	

קובץ תיאור hyperparameters :

## הרצה מספר 1 :

```
- 15s 10ms/step - loss: 1.2886 - sparse_categorical_accuracy: 0.5713 - val_loss: 0.2841 - val_sparse_categorical_accuracy: 0.9151
- 2s 4ms/step - loss: 0.3906 - sparse_categorical_accuracy: 0.8782 - val_loss: 0.2280 - val_sparse_categorical_accuracy: 0.9304
- 2s 4ms/step - loss: 0.3159 - sparse_categorical_accuracy: 0.9033 - val_loss: 0.2003 - val_sparse_categorical_accuracy: 0.9372
- 3s 4ms/step - loss: 0.2822 - sparse_categorical_accuracy: 0.9127 - val_loss: 0.1909 - val_sparse_categorical_accuracy: 0.9407
- 2s 4ms/step - loss: 0.2537 - sparse_categorical_accuracy: 0.9210 - val_loss: 0.1742 - val_sparse_categorical_accuracy: 0.9459
- 4s 7ms/step - loss: 0.2410 - sparse_categorical_accuracy: 0.9264 - val_loss: 0.1771 - val_sparse_categorical_accuracy: 0.9464
- 4s 4ms/step - loss: 0.2340 - sparse_categorical_accuracy: 0.9272 - val_loss: 0.1707 - val_sparse_categorical_accuracy: 0.9481
- 3s 4ms/step - loss: 0.2108 - sparse_categorical_accuracy: 0.9354 - val_loss: 0.1743 - val_sparse_categorical_accuracy: 0.9474
- 3s 4ms/step - loss: 0.1965 - sparse_categorical_accuracy: 0.9402 - val_loss: 0.1630 - val_sparse_categorical_accuracy: 0.9488
- 3s 6ms/step - loss: 0.1872 - sparse_categorical_accuracy: 0.9425 - val_loss: 0.1620 - val_sparse_categorical_accuracy: 0.9513
```

## הרצה מספר 2:

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9s 4ms/step - loss: 0.3520 - sparse_categorical_accuracy: 0.8914 - val_loss: 0.2010 - val_sparse_categorical_accuracy: 0.9445
2s 4ms/step - loss: 0.2701 - sparse_categorical_accuracy: 0.9167 - val_loss: 0.1757 - val_sparse_categorical_accuracy: 0.9445
2s 4ms/step - loss: 0.2327 - sparse_categorical_accuracy: 0.9283 - val_loss: 0.1604 - val_sparse_categorical_accuracy: 0.9519
4s 6ms/step - loss: 0.2130 - sparse_categorical_accuracy: 0.9341 - val_loss: 0.1478 - val_sparse_categorical_accuracy: 0.9556
2s 4ms/step - loss: 0.1940 - sparse_categorical_accuracy: 0.9406 - val_loss: 0.1460 - val_sparse_categorical_accuracy: 0.9575
2s 4ms/step - loss: 0.1753 - sparse_categorical_accuracy: 0.9449 - val_loss: 0.1338 - val_sparse_categorical_accuracy: 0.9588
2s 4ms/step - loss: 0.1684 - sparse_categorical_accuracy: 0.9473 - val_loss: 0.1358 - val_sparse_categorical_accuracy: 0.9593
3s 4ms/step - loss: 0.1609 - sparse_categorical_accuracy: 0.9507 - val_loss: 0.1372 - val_sparse_categorical_accuracy: 0.9597
2s 4ms/step - loss: 0.1490 - sparse_categorical_accuracy: 0.9534 - val_loss: 0.1349 - val_sparse_categorical_accuracy: 0.9612
3s 6ms/step - loss: 0.1450 - sparse_categorical_accuracy: 0.9573 - val_loss: 0.1291 - val_sparse_categorical_accuracy: 0.9609
2s 4ms/step - loss: 0.1320 - sparse_categorical_accuracy: 0.9599 - val_loss: 0.1238 - val_sparse_categorical_accuracy: 0.9630
3s 4ms/step - loss: 0.1266 - sparse_categorical_accuracy: 0.9605 - val_loss: 0.1288 - val_sparse_categorical_accuracy: 0.9629
2s 4ms/step - loss: 0.1252 - sparse_categorical_accuracy: 0.9613 - val_loss: 0.1215 - val_sparse_categorical_accuracy: 0.9649
2s 4ms/step - loss: 0.1207 - sparse_categorical_accuracy: 0.9622 - val_loss: 0.1259 - val_sparse_categorical_accuracy: 0.9633
4s 7ms/step - loss: 0.1142 - sparse_categorical_accuracy: 0.9646 - val_loss: 0.1332 - val_sparse_categorical_accuracy: 0.9611
4s 4ms/step - loss: 0.1111 - sparse_categorical_accuracy: 0.9643 - val_loss: 0.1202 - val_sparse_categorical_accuracy: 0.9643
2s 4ms/step - loss: 0.1069 - sparse_categorical_accuracy: 0.9666 - val_loss: 0.1165 - val_sparse_categorical_accuracy: 0.9642
2s 4ms/step - loss: 0.1051 - sparse_categorical_accuracy: 0.9678 - val_loss: 0.1260 - val_sparse_categorical_accuracy: 0.9634
3s 5ms/step - loss: 0.1010 - sparse_categorical_accuracy: 0.9686 - val_loss: 0.1330 - val_sparse_categorical_accuracy: 0.9605
```

## הרצה מספר 3:

Epoch 3/20  
469/469 ————— 4s 4ms/step - loss: 0.5446 - sparse\_categorical\_accuracy: 0.8480 - val\_loss: 0.3493 - val\_sparse\_categorical\_accu  
Epoch 4/20  
469/469 ————— 3s 4ms/step - loss: 0.4475 - sparse\_categorical\_accuracy: 0.8715 - val\_loss: 0.2996 - val\_sparse\_categorical\_accu  
Epoch 5/20  
469/469 ————— 2s 4ms/step - loss: 0.3879 - sparse\_categorical\_accuracy: 0.8865 - val\_loss: 0.2706 - val\_sparse\_categorical\_accu  
Epoch 6/20  
469/469 ————— 3s 5ms/step - loss: 0.3520 - sparse\_categorical\_accuracy: 0.8973 - val\_loss: 0.2480 - val\_sparse\_categorical\_accu  
Epoch 7/20  
469/469 ————— 3s 6ms/step - loss: 0.3207 - sparse\_categorical\_accuracy: 0.9067 - val\_loss: 0.2339 - val\_sparse\_categorical\_accu  
Epoch 8/20  
469/469 ————— 2s 4ms/step - loss: 0.2978 - sparse\_categorical\_accuracy: 0.9127 - val\_loss: 0.2180 - val\_sparse\_categorical\_accu  
Epoch 9/20  
469/469 ————— 2s 4ms/step - loss: 0.2890 - sparse\_categorical\_accuracy: 0.9140 - val\_loss: 0.2081 - val\_sparse\_categorical\_accu  
Epoch 10/20  
469/469 ————— 2s 4ms/step - loss: 0.2691 - sparse\_categorical\_accuracy: 0.9201 - val\_loss: 0.2015 - val\_sparse\_categorical\_accu  
Epoch 11/20  
469/469 ————— 3s 4ms/step - loss: 0.2567 - sparse\_categorical\_accuracy: 0.9239 - val\_loss: 0.1926 - val\_sparse\_categorical\_accu  
Epoch 12/20  
469/469 ————— 3s 6ms/step - loss: 0.2468 - sparse\_categorical\_accuracy: 0.9274 - val\_loss: 0.1854 - val\_sparse\_categorical\_accu  
Epoch 13/20  
469/469 ————— 3s 6ms/step - loss: 0.2373 - sparse\_categorical\_accuracy: 0.9283 - val\_loss: 0.1794 - val\_sparse\_categorical\_accu  
Epoch 14/20  
469/469 ————— 2s 4ms/step - loss: 0.2314 - sparse\_categorical\_accuracy: 0.9292 - val\_loss: 0.1728 - val\_sparse\_categorical\_accu  
Epoch 15/20  
469/469 ————— 3s 4ms/step - loss: 0.2181 - sparse\_categorical\_accuracy: 0.9338 - val\_loss: 0.1692 - val\_sparse\_categorical\_accu  
Epoch 16/20  
469/469 ————— 3s 4ms/step - loss: 0.2131 - sparse\_categorical\_accuracy: 0.9358 - val\_loss: 0.1662 - val\_sparse\_categorical\_accu  
Epoch 17/20  
469/469 ————— 3s 5ms/step - loss: 0.2114 - sparse\_categorical\_accuracy: 0.9364 - val\_loss: 0.1625 - val\_sparse\_categorical\_accu  
Epoch 18/20  
469/469 ————— 3s 6ms/step - loss: 0.2019 - sparse\_categorical\_accuracy: 0.9393 - val\_loss: 0.1587 - val\_sparse\_categorical\_accu  
Epoch 19/20  
469/469 ————— 2s 4ms/step - loss: 0.1931 - sparse\_categorical\_accuracy: 0.9419 - val\_loss: 0.1547 - val\_sparse\_categorical\_accu  
Epoch 20/20  
469/469 ————— 3s 4ms/step - loss: 0.1828 - sparse\_categorical\_accuracy: 0.9444 - val\_loss: 0.1548 - val\_sparse\_categorical\_accu

## הרצה מספר 4 :

————— 5s 3ms/step - loss: 2.3100 - sparse\_categorical\_accuracy: 0.1033 - val\_loss: 2.3150 - val\_sparse\_categorical\_accuracy: 0.0958  
————— 3s 3ms/step - loss: 2.3114 - sparse\_categorical\_accuracy: 0.1042 - val\_loss: 2.3104 - val\_sparse\_categorical\_accuracy: 0.0958  
————— 6s 5ms/step - loss: 2.3115 - sparse\_categorical\_accuracy: 0.1020 - val\_loss: 2.3121 - val\_sparse\_categorical\_accuracy: 0.1009  
————— 4s 3ms/step - loss: 2.3090 - sparse\_categorical\_accuracy: 0.1048 - val\_loss: 2.3071 - val\_sparse\_categorical\_accuracy: 0.1010  
————— 6s 4ms/step - loss: 2.3107 - sparse\_categorical\_accuracy: 0.1038 - val\_loss: 2.3180 - val\_sparse\_categorical\_accuracy: 0.0892  
————— 5s 6ms/step - loss: 2.3111 - sparse\_categorical\_accuracy: 0.1040 - val\_loss: 2.3094 - val\_sparse\_categorical\_accuracy: 0.0974  
————— 8s 4ms/step - loss: 2.3116 - sparse\_categorical\_accuracy: 0.1079 - val\_loss: 2.3024 - val\_sparse\_categorical\_accuracy: 0.1028  
————— 6s 5ms/step - loss: 2.3107 - sparse\_categorical\_accuracy: 0.1045 - val\_loss: 2.3187 - val\_sparse\_categorical\_accuracy: 0.0980  
————— 4s 3ms/step - loss: 2.3110 - sparse\_categorical\_accuracy: 0.1069 - val\_loss: 2.3080 - val\_sparse\_categorical\_accuracy: 0.1135  
————— 5s 3ms/step - loss: 2.3093 - sparse\_categorical\_accuracy: 0.1035 - val\_loss: 2.3112 - val\_sparse\_categorical\_accuracy: 0.1010  
————— 4s 4ms/step - loss: 2.3090 - sparse\_categorical\_accuracy: 0.1058 - val\_loss: 2.3093 - val\_sparse\_categorical\_accuracy: 0.0974  
————— 3s 3ms/step - loss: 2.3097 - sparse\_categorical\_accuracy: 0.1036 - val\_loss: 2.3108 - val\_sparse\_categorical\_accuracy: 0.0980  
————— 5s 3ms/step - loss: 2.3090 - sparse\_categorical\_accuracy: 0.1035 - val\_loss: 2.3125 - val\_sparse\_categorical\_accuracy: 0.1135  
————— 4s 4ms/step - loss: 2.3111 - sparse\_categorical\_accuracy: 0.1030 - val\_loss: 2.3090 - val\_sparse\_categorical\_accuracy: 0.1009  
————— 4s 3ms/step - loss: 2.3107 - sparse\_categorical\_accuracy: 0.1050 - val\_loss: 2.3096 - val\_sparse\_categorical\_accuracy: 0.0974  
————— 5s 3ms/step - loss: 2.3097 - sparse\_categorical\_accuracy: 0.1052 - val\_loss: 2.3073 - val\_sparse\_categorical\_accuracy: 0.1010

## הרצה מספר 5 :

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Epoch 9/30
938/938 5s 3ms/step - loss: 0.2012 - sparse_categorical_accuracy: 0.9415 - val_loss: 0.1612 - val_sparse_categorical_accuracy: 0.9546
Epoch 9/30
938/938 4s 4ms/step - loss: 0.1973 - sparse_categorical_accuracy: 0.9426 - val_loss: 0.1687 - val_sparse_categorical_accuracy: 0.9525
Epoch 10/30
938/938 3s 3ms/step - loss: 0.1986 - sparse_categorical_accuracy: 0.9438 - val_loss: 0.1755 - val_sparse_categorical_accuracy: 0.9528
Epoch 11/30
938/938 5s 3ms/step - loss: 0.1916 - sparse_categorical_accuracy: 0.9448 - val_loss: 0.1582 - val_sparse_categorical_accuracy: 0.9575
Epoch 12/30
938/938 4s 4ms/step - loss: 0.1904 - sparse_categorical_accuracy: 0.9445 - val_loss: 0.1733 - val_sparse_categorical_accuracy: 0.9530
Epoch 13/30
938/938 4s 3ms/step - loss: 0.1863 - sparse_categorical_accuracy: 0.9475 - val_loss: 0.1757 - val_sparse_categorical_accuracy: 0.9530
Epoch 14/30
938/938 3s 3ms/step - loss: 0.1806 - sparse_categorical_accuracy: 0.9467 - val_loss: 0.1656 - val_sparse_categorical_accuracy: 0.9551
Epoch 15/30
938/938 6s 5ms/step - loss: 0.1795 - sparse_categorical_accuracy: 0.9486 - val_loss: 0.1651 - val_sparse_categorical_accuracy: 0.9559
Epoch 16/30
938/938 4s 3ms/step - loss: 0.1873 - sparse_categorical_accuracy: 0.9455 - val_loss: 0.1671 - val_sparse_categorical_accuracy: 0.9544
Epoch 17/30
938/938 5s 3ms/step - loss: 0.1770 - sparse_categorical_accuracy: 0.9490 - val_loss: 0.1785 - val_sparse_categorical_accuracy: 0.9521
Epoch 18/30
938/938 5s 5ms/step - loss: 0.1808 - sparse_categorical_accuracy: 0.9482 - val_loss: 0.1752 - val_sparse_categorical_accuracy: 0.9533
Epoch 19/30
938/938 4s 3ms/step - loss: 0.1722 - sparse_categorical_accuracy: 0.9500 - val_loss: 0.1698 - val_sparse_categorical_accuracy: 0.9547
Epoch 20/30
938/938 5s 3ms/step - loss: 0.1856 - sparse_categorical_accuracy: 0.9480 - val_loss: 0.1664 - val_sparse_categorical_accuracy: 0.9556
Epoch 21/30
938/938 6s 4ms/step - loss: 0.1728 - sparse_categorical_accuracy: 0.9505 - val_loss: 0.1729 - val_sparse_categorical_accuracy: 0.9546
Epoch 22/30
938/938 3s 3ms/step - loss: 0.1779 - sparse_categorical_accuracy: 0.9492 - val_loss: 0.1698 - val_sparse_categorical_accuracy: 0.9544
Epoch 23/30
938/938 5s 3ms/step - loss: 0.1680 - sparse_categorical_accuracy: 0.9531 - val_loss: 0.1638 - val_sparse_categorical_accuracy: 0.9554
Epoch 24/30
938/938 5s 5ms/step - loss: 0.1678 - sparse_categorical_accuracy: 0.9513 - val_loss: 0.1789 - val_sparse_categorical_accuracy: 0.9519
Epoch 25/30
938/938 3s 3ms/step - loss: 0.1739 - sparse_categorical_accuracy: 0.9498 - val_loss: 0.1684 - val_sparse_categorical_accuracy: 0.9539
Epoch 26/30
938/938 6s 4ms/step - loss: 0.1669 - sparse_categorical_accuracy: 0.9529 - val_loss: 0.1587 - val_sparse_categorical_accuracy: 0.9585
Epoch 27/30
938/938 5s 5ms/step - loss: 0.1700 - sparse_categorical_accuracy: 0.9505 - val_loss: 0.1738 - val_sparse_categorical_accuracy: 0.9519
Epoch 28/30
938/938 3s 3ms/step - loss: 0.1649 - sparse_categorical_accuracy: 0.9534 - val_loss: 0.1731 - val_sparse_categorical_accuracy: 0.9532
Epoch 29/30
938/938 5s 3ms/step - loss: 0.1683 - sparse_categorical_accuracy: 0.9523 - val_loss: 0.1761 - val_sparse_categorical_accuracy: 0.9540
Epoch 30/30
938/938 6s 4ms/step - loss: 0.1722 - sparse_categorical_accuracy: 0.9504 - val_loss: 0.1553 - val_sparse_categorical_accuracy: 0.9592

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## הרצה מספר 6 :

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Epoch 1/10
1875/1875 19s 5ms/step - loss: 0.5257 - sparse_categorical_accuracy: 0.8447 - val_loss: 0.2431 - val_sparse_categorical_accuracy: 0.9330
Epoch 2/10
1875/1875 10s 3ms/step - loss: 0.2676 - sparse_categorical_accuracy: 0.9238 - val_loss: 0.2011 - val_sparse_categorical_accuracy: 0.9441
Epoch 3/10
1875/1875 5s 3ms/step - loss: 0.2362 - sparse_categorical_accuracy: 0.9333 - val_loss: 0.2204 - val_sparse_categorical_accuracy: 0.9411
Epoch 4/10
1875/1875 5s 3ms/step - loss: 0.2172 - sparse_categorical_accuracy: 0.9386 - val_loss: 0.2166 - val_sparse_categorical_accuracy: 0.9383
Epoch 5/10
1875/1875 10s 3ms/step - loss: 0.2156 - sparse_categorical_accuracy: 0.9408 - val_loss: 0.2116 - val_sparse_categorical_accuracy: 0.9458
Epoch 6/10
1875/1875 10s 3ms/step - loss: 0.2094 - sparse_categorical_accuracy: 0.9424 - val_loss: 0.2061 - val_sparse_categorical_accuracy: 0.9461
Epoch 7/10
1875/1875 10s 3ms/step - loss: 0.2088 - sparse_categorical_accuracy: 0.9426 - val_loss: 0.2128 - val_sparse_categorical_accuracy: 0.9427
Epoch 8/10
1875/1875 5s 3ms/step - loss: 0.2026 - sparse_categorical_accuracy: 0.9449 - val_loss: 0.2055 - val_sparse_categorical_accuracy: 0.9450
Epoch 9/10
1875/1875 10s 3ms/step - loss: 0.1983 - sparse_categorical_accuracy: 0.9439 - val_loss: 0.2229 - val_sparse_categorical_accuracy: 0.9428
Epoch 10/10
1875/1875 10s 3ms/step - loss: 0.2007 - sparse_categorical_accuracy: 0.9449 - val_loss: 0.2146 - val_sparse_categorical_accuracy: 0.9427

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## הרצה מספר 7 :

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Epoch 1/10
469/469 14s 8ms/step - loss: 2.3943 - sparse_categorical_accuracy: 0.1009 - val_loss: 2.3505 - val_sparse_categorical_accuracy: 0.1010
Epoch 2/10
469/469 11s 4ms/step - loss: 2.3316 - sparse_categorical_accuracy: 0.1027 - val_loss: 2.3411 - val_sparse_categorical_accuracy: 0.0892
Epoch 3/10
469/469 3s 6ms/step - loss: 2.3329 - sparse_categorical_accuracy: 0.1039 - val_loss: 2.3360 - val_sparse_categorical_accuracy: 0.1009
Epoch 4/10
469/469 4s 4ms/step - loss: 2.3290 - sparse_categorical_accuracy: 0.1022 - val_loss: 2.3264 - val_sparse_categorical_accuracy: 0.1135
Epoch 5/10
469/469 2s 4ms/step - loss: 2.3303 - sparse_categorical_accuracy: 0.1035 - val_loss: 2.3464 - val_sparse_categorical_accuracy: 0.0958
Epoch 6/10
469/469 2s 4ms/step - loss: 2.3327 - sparse_categorical_accuracy: 0.1010 - val_loss: 2.3197 - val_sparse_categorical_accuracy: 0.0958
Epoch 7/10
469/469 2s 5ms/step - loss: 2.3317 - sparse_categorical_accuracy: 0.1041 - val_loss: 2.3278 - val_sparse_categorical_accuracy: 0.0982
Epoch 8/10
469/469 3s 5ms/step - loss: 2.3298 - sparse_categorical_accuracy: 0.0978 - val_loss: 2.3477 - val_sparse_categorical_accuracy: 0.0980
Epoch 9/10
469/469 4s 4ms/step - loss: 2.3354 - sparse_categorical_accuracy: 0.1011 - val_loss: 2.3277 - val_sparse_categorical_accuracy: 0.1032
Epoch 10/10
469/469 3s 4ms/step - loss: 2.3296 - sparse_categorical_accuracy: 0.1014 - val_loss: 2.3962 - val_sparse_categorical_accuracy: 0.0958

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## הרצה מספר 8 :

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Epoch 1/20
469/469 — 15s 10ms/step - loss: 2.0781 - sparse_categorical_accuracy: 0.2611 - val_loss: 1.0327 - val_sparse_categorical_accuracy: 0.7631
Epoch 2/20
469/469 — 2s 4ms/step - loss: 0.9088 - sparse_categorical_accuracy: 0.7391 - val_loss: 0.4959 - val_sparse_categorical_accuracy: 0.8726
Epoch 3/20
469/469 — 2s 4ms/step - loss: 0.5572 - sparse_categorical_accuracy: 0.8379 - val_loss: 0.3711 - val_sparse_categorical_accuracy: 0.8972
Epoch 4/20
469/469 — 2s 4ms/step - loss: 0.4459 - sparse_categorical_accuracy: 0.8680 - val_loss: 0.3179 - val_sparse_categorical_accuracy: 0.9104
Epoch 5/20
469/469 — 3s 6ms/step - loss: 0.3931 - sparse_categorical_accuracy: 0.8821 - val_loss: 0.2817 - val_sparse_categorical_accuracy: 0.9188
Epoch 6/20
469/469 — 4s 4ms/step - loss: 0.3558 - sparse_categorical_accuracy: 0.8912 - val_loss: 0.2606 - val_sparse_categorical_accuracy: 0.9231
Epoch 7/20
469/469 — 2s 4ms/step - loss: 0.3278 - sparse_categorical_accuracy: 0.9004 - val_loss: 0.2417 - val_sparse_categorical_accuracy: 0.9293
Epoch 8/20
469/469 — 3s 4ms/step - loss: 0.2947 - sparse_categorical_accuracy: 0.9095 - val_loss: 0.2270 - val_sparse_categorical_accuracy: 0.9329
Epoch 9/20
469/469 — 3s 5ms/step - loss: 0.2755 - sparse_categorical_accuracy: 0.9167 - val_loss: 0.2157 - val_sparse_categorical_accuracy: 0.9360
Epoch 10/20
469/469 — 3s 6ms/step - loss: 0.2664 - sparse_categorical_accuracy: 0.9175 - val_loss: 0.2047 - val_sparse_categorical_accuracy: 0.9392
Epoch 11/20
469/469 — 4s 4ms/step - loss: 0.2423 - sparse_categorical_accuracy: 0.9242 - val_loss: 0.1951 - val_sparse_categorical_accuracy: 0.9408
Epoch 12/20
469/469 — 2s 4ms/step - loss: 0.2392 - sparse_categorical_accuracy: 0.9284 - val_loss: 0.1877 - val_sparse_categorical_accuracy: 0.9429
Epoch 13/20
469/469 — 2s 4ms/step - loss: 0.2218 - sparse_categorical_accuracy: 0.9308 - val_loss: 0.1814 - val_sparse_categorical_accuracy: 0.9445
Epoch 14/20
469/469 — 3s 6ms/step - loss: 0.2130 - sparse_categorical_accuracy: 0.9333 - val_loss: 0.1748 - val_sparse_categorical_accuracy: 0.9473
Epoch 15/20
469/469 — 3s 5ms/step - loss: 0.2094 - sparse_categorical_accuracy: 0.9353 - val_loss: 0.1702 - val_sparse_categorical_accuracy: 0.9497
Epoch 16/20
469/469 — 4s 4ms/step - loss: 0.1995 - sparse_categorical_accuracy: 0.9371 - val_loss: 0.1646 - val_sparse_categorical_accuracy: 0.9514
Epoch 17/20
469/469 — 2s 4ms/step - loss: 0.1901 - sparse_categorical_accuracy: 0.9417 - val_loss: 0.1596 - val_sparse_categorical_accuracy: 0.9527
Epoch 18/20
469/469 — 2s 4ms/step - loss: 0.1871 - sparse_categorical_accuracy: 0.9420 - val_loss: 0.1568 - val_sparse_categorical_accuracy: 0.9541
Epoch 19/20
469/469 — 3s 5ms/step - loss: 0.1753 - sparse_categorical_accuracy: 0.9455 - val_loss: 0.1546 - val_sparse_categorical_accuracy: 0.9541
Epoch 20/20
469/469 — 3s 6ms/step - loss: 0.1801 - sparse_categorical_accuracy: 0.9441 - val_loss: 0.1507 - val_sparse_categorical_accuracy: 0.9539

```

## הרצה מספר 9 :

```

Epoch 1/20
469/469 — 22s 17ms/step - loss: 2.4324 - sparse_categorical_accuracy: 0.1030 - val_loss: 2.3092 - val_sparse_categorical_accuracy: 0.1010
Epoch 2/20
469/469 — 2s 4ms/step - loss: 2.3122 - sparse_categorical_accuracy: 0.1048 - val_loss: 2.3058 - val_sparse_categorical_accuracy: 0.1028
Epoch 3/20
469/469 — 2s 4ms/step - loss: 2.3124 - sparse_categorical_accuracy: 0.1028 - val_loss: 2.3081 - val_sparse_categorical_accuracy: 0.1028
Epoch 4/20
469/469 — 2s 4ms/step - loss: 2.3132 - sparse_categorical_accuracy: 0.1016 - val_loss: 2.3173 - val_sparse_categorical_accuracy: 0.1135
Epoch 5/20
469/469 — 2s 4ms/step - loss: 2.3122 - sparse_categorical_accuracy: 0.1055 - val_loss: 2.3080 - val_sparse_categorical_accuracy: 0.1010
Epoch 6/20
469/469 — 4s 6ms/step - loss: 2.3129 - sparse_categorical_accuracy: 0.1010 - val_loss: 2.3153 - val_sparse_categorical_accuracy: 0.1009
Epoch 7/20
469/469 — 2s 5ms/step - loss: 2.3138 - sparse_categorical_accuracy: 0.1031 - val_loss: 2.3082 - val_sparse_categorical_accuracy: 0.1135
Epoch 8/20
469/469 — 2s 4ms/step - loss: 2.3144 - sparse_categorical_accuracy: 0.1028 - val_loss: 2.3140 - val_sparse_categorical_accuracy: 0.0892
Epoch 9/20
469/469 — 2s 4ms/step - loss: 2.3118 - sparse_categorical_accuracy: 0.1041 - val_loss: 2.3140 - val_sparse_categorical_accuracy: 0.0974
Epoch 10/20
469/469 — 2s 4ms/step - loss: 2.3143 - sparse_categorical_accuracy: 0.1032 - val_loss: 2.3148 - val_sparse_categorical_accuracy: 0.0982
Epoch 11/20
469/469 — 2s 4ms/step - loss: 2.3118 - sparse_categorical_accuracy: 0.1020 - val_loss: 2.3074 - val_sparse_categorical_accuracy: 0.1135
Epoch 12/20
469/469 — 4s 7ms/step - loss: 2.3118 - sparse_categorical_accuracy: 0.1012 - val_loss: 2.3098 - val_sparse_categorical_accuracy: 0.1032
Epoch 13/20
469/469 — 4s 4ms/step - loss: 2.3130 - sparse_categorical_accuracy: 0.1036 - val_loss: 2.3168 - val_sparse_categorical_accuracy: 0.0974
Epoch 14/20
469/469 — 2s 4ms/step - loss: 2.3117 - sparse_categorical_accuracy: 0.1027 - val_loss: 2.3152 - val_sparse_categorical_accuracy: 0.0974
Epoch 15/20
469/469 — 2s 4ms/step - loss: 2.3124 - sparse_categorical_accuracy: 0.1014 - val_loss: 2.3089 - val_sparse_categorical_accuracy: 0.1028
Epoch 16/20
469/469 — 3s 4ms/step - loss: 2.3103 - sparse_categorical_accuracy: 0.1072 - val_loss: 2.3084 - val_sparse_categorical_accuracy: 0.1135
Epoch 17/20
469/469 — 3s 7ms/step - loss: 2.3113 - sparse_categorical_accuracy: 0.1004 - val_loss: 2.3073 - val_sparse_categorical_accuracy: 0.0974
Epoch 18/20
469/469 — 4s 4ms/step - loss: 2.3145 - sparse_categorical_accuracy: 0.1013 - val_loss: 2.3282 - val_sparse_categorical_accuracy: 0.1028
Epoch 19/20
469/469 — 3s 4ms/step - loss: 2.3121 - sparse_categorical_accuracy: 0.1033 - val_loss: 2.3059 - val_sparse_categorical_accuracy: 0.0980
Epoch 20/20
469/469 — 3s 4ms/step - loss: 2.3106 - sparse_categorical_accuracy: 0.1056 - val_loss: 2.3187 - val_sparse_categorical_accuracy: 0.0982

```

## הרצה מספר 10 :

```

Epoch 1/20
469/469 — 15s 10ms/step - loss: 0.7854 - sparse_categorical_accuracy: 0.7586 - val_loss: 0.5349 - val_sparse_categorical_accuracy: 0.8700
Epoch 2/20
469/469 — 11s 4ms/step - loss: 0.3467 - sparse_categorical_accuracy: 0.9131 - val_loss: 0.3447 - val_sparse_categorical_accuracy: 0.9180
Epoch 3/20
469/469 — 3s 6ms/step - loss: 0.3250 - sparse_categorical_accuracy: 0.9194 - val_loss: 0.3434 - val_sparse_categorical_accuracy: 0.9227
Epoch 4/20
469/469 — 2s 4ms/step - loss: 0.3219 - sparse_categorical_accuracy: 0.9243 - val_loss: 0.3512 - val_sparse_categorical_accuracy: 0.9200
Epoch 5/20
469/469 — 3s 4ms/step - loss: 0.3009 - sparse_categorical_accuracy: 0.9276 - val_loss: 0.3793 - val_sparse_categorical_accuracy: 0.9196
Epoch 6/20
469/469 — 4s 6ms/step - loss: 0.3199 - sparse_categorical_accuracy: 0.9259 - val_loss: 0.5276 - val_sparse_categorical_accuracy: 0.8878
Epoch 7/20
469/469 — 5s 6ms/step - loss: 0.3753 - sparse_categorical_accuracy: 0.9135 - val_loss: 0.4094 - val_sparse_categorical_accuracy: 0.9151
Epoch 8/20
469/469 — 2s 4ms/step - loss: 0.3526 - sparse_categorical_accuracy: 0.9194 - val_loss: 0.7918 - val_sparse_categorical_accuracy: 0.8792
Epoch 9/20
469/469 — 2s 4ms/step - loss: 0.3719 - sparse_categorical_accuracy: 0.9168 - val_loss: 0.3088 - val_sparse_categorical_accuracy: 0.9344
Epoch 10/20
469/469 — 3s 4ms/step - loss: 0.2707 - sparse_categorical_accuracy: 0.9348 - val_loss: 0.6038 - val_sparse_categorical_accuracy: 0.8991
Epoch 11/20
469/469 — 2s 4ms/step - loss: 0.4177 - sparse_categorical_accuracy: 0.9083 - val_loss: 0.3373 - val_sparse_categorical_accuracy: 0.9249
Epoch 12/20
469/469 — 2s 5ms/step - loss: 0.2737 - sparse_categorical_accuracy: 0.9368 - val_loss: 0.3683 - val_sparse_categorical_accuracy: 0.9135
Epoch 13/20
469/469 — 3s 6ms/step - loss: 0.2935 - sparse_categorical_accuracy: 0.9313 - val_loss: 0.2908 - val_sparse_categorical_accuracy: 0.9427
Epoch 14/20
469/469 — 2s 4ms/step - loss: 0.2760 - sparse_categorical_accuracy: 0.9374 - val_loss: 0.3310 - val_sparse_categorical_accuracy: 0.9320
Epoch 15/20
469/469 — 2s 4ms/step - loss: 0.3008 - sparse_categorical_accuracy: 0.9326 - val_loss: 0.5065 - val_sparse_categorical_accuracy: 0.8753
Epoch 16/20
469/469 — 3s 4ms/step - loss: 0.3797 - sparse_categorical_accuracy: 0.9128 - val_loss: 0.3948 - val_sparse_categorical_accuracy: 0.9172
Epoch 17/20
469/469 — 2s 4ms/step - loss: 0.3494 - sparse_categorical_accuracy: 0.9221 - val_loss: 0.4645 - val_sparse_categorical_accuracy: 0.9205
Epoch 18/20
469/469 — 2s 5ms/step - loss: 0.3213 - sparse_categorical_accuracy: 0.9313 - val_loss: 0.3649 - val_sparse_categorical_accuracy: 0.9251
Epoch 19/20
469/469 — 3s 6ms/step - loss: 0.2811 - sparse_categorical_accuracy: 0.9352 - val_loss: 0.6636 - val_sparse_categorical_accuracy: 0.8553
Epoch 20/20
469/469 — 2s 4ms/step - loss: 0.5473 - sparse_categorical_accuracy: 0.8699 - val_loss: 0.4367 - val_sparse_categorical_accuracy: 0.8979

```

## הרצה מספר 11:

```

Epoch 1/20
1875/1875 — 19s 4ms/step - loss: 2.0121 - sparse_categorical_accuracy: 0.2892 - val_loss: 2.1615 - val_sparse_categorical_accuracy: 0.1980
Epoch 2/20
1875/1875 — 5s 3ms/step - loss: 2.2139 - sparse_categorical_accuracy: 0.1734 - val_loss: 2.2196 - val_sparse_categorical_accuracy: 0.1773
Epoch 3/20
1875/1875 — 5s 3ms/step - loss: 2.2396 - sparse_categorical_accuracy: 0.1672 - val_loss: 2.2537 - val_sparse_categorical_accuracy: 0.1791
Epoch 4/20
1875/1875 — 6s 3ms/step - loss: 2.3290 - sparse_categorical_accuracy: 0.1603 - val_loss: 2.1334 - val_sparse_categorical_accuracy: 0.1833
Epoch 5/20
1875/1875 — 6s 3ms/step - loss: 2.2424 - sparse_categorical_accuracy: 0.1662 - val_loss: 2.1726 - val_sparse_categorical_accuracy: 0.1842
Epoch 6/20
1875/1875 — 10s 3ms/step - loss: 2.2378 - sparse_categorical_accuracy: 0.1639 - val_loss: 2.2532 - val_sparse_categorical_accuracy: 0.1084
Epoch 7/20
1875/1875 — 6s 3ms/step - loss: 2.2831 - sparse_categorical_accuracy: 0.1623 - val_loss: 2.2961 - val_sparse_categorical_accuracy: 0.1615
Epoch 8/20
1875/1875 — 10s 3ms/step - loss: 2.3088 - sparse_categorical_accuracy: 0.1508 - val_loss: 2.4625 - val_sparse_categorical_accuracy: 0.1029
Epoch 9/20
1875/1875 — 6s 3ms/step - loss: 2.4901 - sparse_categorical_accuracy: 0.1032 - val_loss: 2.5270 - val_sparse_categorical_accuracy: 0.0974
Epoch 10/20
1875/1875 — 10s 3ms/step - loss: 2.4872 - sparse_categorical_accuracy: 0.1006 - val_loss: 2.4795 - val_sparse_categorical_accuracy: 0.0982
Epoch 11/20
1875/1875 — 9s 3ms/step - loss: 2.4916 - sparse_categorical_accuracy: 0.0997 - val_loss: 2.4613 - val_sparse_categorical_accuracy: 0.1009
Epoch 12/20
1875/1875 — 7s 4ms/step - loss: 2.4872 - sparse_categorical_accuracy: 0.1020 - val_loss: 2.4878 - val_sparse_categorical_accuracy: 0.0974
Epoch 13/20
1875/1875 — 9s 3ms/step - loss: 2.4927 - sparse_categorical_accuracy: 0.0985 - val_loss: 2.4110 - val_sparse_categorical_accuracy: 0.1032
Epoch 14/20
1875/1875 — 7s 3ms/step - loss: 2.4778 - sparse_categorical_accuracy: 0.1018 - val_loss: 2.4353 - val_sparse_categorical_accuracy: 0.0958
Epoch 15/20
1875/1875 — 5s 3ms/step - loss: 2.4896 - sparse_categorical_accuracy: 0.1004 - val_loss: 2.5018 - val_sparse_categorical_accuracy: 0.1032
Epoch 16/20
1875/1875 — 11s 3ms/step - loss: 2.5032 - sparse_categorical_accuracy: 0.1017 - val_loss: 2.4205 - val_sparse_categorical_accuracy: 0.0902
Epoch 17/20
1875/1875 — 12s 4ms/step - loss: 2.5024 - sparse_categorical_accuracy: 0.1019 - val_loss: 2.4819 - val_sparse_categorical_accuracy: 0.1028
Epoch 18/20
1875/1875 — 5s 3ms/step - loss: 2.4852 - sparse_categorical_accuracy: 0.0976 - val_loss: 2.5967 - val_sparse_categorical_accuracy: 0.0900
Epoch 19/20
1875/1875 — 6s 3ms/step - loss: 2.4875 - sparse_categorical_accuracy: 0.0999 - val_loss: 2.6755 - val_sparse_categorical_accuracy: 0.1135
Epoch 20/20
1875/1875 — 5s 3ms/step - loss: 2.4860 - sparse_categorical_accuracy: 0.1052 - val_loss: 2.4276 - val_sparse_categorical_accuracy: 0.0974

```



## הרצה מספר 12:

Epoch 2/30	9s	3ms/step	loss: 1.6145	sparse_categorical_accuracy: 0.4284	val_loss: 1.5797	val_sparse_categorical_accuracy: 0.4417
Epoch 3/30	3s	3ms/step	loss: 1.6953	sparse_categorical_accuracy: 0.3796	val_loss: 1.8517	val_sparse_categorical_accuracy: 0.3776
Epoch 4/30	3s	3ms/step	loss: 1.9551	sparse_categorical_accuracy: 0.2634	val_loss: 2.2853	val_sparse_categorical_accuracy: 0.1781
Epoch 5/30	5s	5ms/step	loss: 2.1397	sparse_categorical_accuracy: 0.1790	val_loss: 1.9598	val_sparse_categorical_accuracy: 0.1934
Epoch 6/30	3s	3ms/step	loss: 1.9891	sparse_categorical_accuracy: 0.2503	val_loss: 1.8915	val_sparse_categorical_accuracy: 0.2419
Epoch 7/30	5s	3ms/step	loss: 1.9810	sparse_categorical_accuracy: 0.2448	val_loss: 1.8794	val_sparse_categorical_accuracy: 0.2366
Epoch 8/30	4s	4ms/step	loss: 1.9361	sparse_categorical_accuracy: 0.2538	val_loss: 2.0180	val_sparse_categorical_accuracy: 0.3082
Epoch 9/30	4s	4ms/step	loss: 1.9482	sparse_categorical_accuracy: 0.2650	val_loss: 2.0121	val_sparse_categorical_accuracy: 0.2292
Epoch 10/30	4s	3ms/step	loss: 2.0580	sparse_categorical_accuracy: 0.2274	val_loss: 1.9611	val_sparse_categorical_accuracy: 0.2791
Epoch 11/30	6s	5ms/step	loss: 1.9483	sparse_categorical_accuracy: 0.2537	val_loss: 2.0571	val_sparse_categorical_accuracy: 0.2495
Epoch 12/30	3s	3ms/step	loss: 2.0233	sparse_categorical_accuracy: 0.2368	val_loss: 2.1659	val_sparse_categorical_accuracy: 0.1637
Epoch 13/30	3s	3ms/step	loss: 2.0599	sparse_categorical_accuracy: 0.2055	val_loss: 1.9116	val_sparse_categorical_accuracy: 0.2266
Epoch 14/30	4s	4ms/step	loss: 1.9710	sparse_categorical_accuracy: 0.2473	val_loss: 2.0835	val_sparse_categorical_accuracy: 0.1464
Epoch 15/30	4s	4ms/step	loss: 2.0972	sparse_categorical_accuracy: 0.1834	val_loss: 2.0485	val_sparse_categorical_accuracy: 0.2065
Epoch 16/30	4s	3ms/step	loss: 2.1259	sparse_categorical_accuracy: 0.1880	val_loss: 2.2266	val_sparse_categorical_accuracy: 0.1906
Epoch 17/30	7s	6ms/step	loss: 2.1383	sparse_categorical_accuracy: 0.1862	val_loss: 2.1075	val_sparse_categorical_accuracy: 0.1436
Epoch 18/30	8s	3ms/step	loss: 2.1316	sparse_categorical_accuracy: 0.1728	val_loss: 2.2491	val_sparse_categorical_accuracy: 0.1524
Epoch 19/30	4s	4ms/step	loss: 2.1280	sparse_categorical_accuracy: 0.1781	val_loss: 2.0168	val_sparse_categorical_accuracy: 0.1787
Epoch 20/30	5s	3ms/step	loss: 2.0801	sparse_categorical_accuracy: 0.1845	val_loss: 2.0934	val_sparse_categorical_accuracy: 0.2087
Epoch 21/30	3s	3ms/step	loss: 2.1320	sparse_categorical_accuracy: 0.1768	val_loss: 2.0658	val_sparse_categorical_accuracy: 0.1959
Epoch 22/30	3s	3ms/step	loss: 2.1252	sparse_categorical_accuracy: 0.1718	val_loss: 2.2707	val_sparse_categorical_accuracy: 0.1638
Epoch 23/30	5s	3ms/step	loss: 2.1458	sparse_categorical_accuracy: 0.1747	val_loss: 2.1728	val_sparse_categorical_accuracy: 0.1581
Epoch 24/30	3s	3ms/step	loss: 2.1407	sparse_categorical_accuracy: 0.1754	val_loss: 2.0939	val_sparse_categorical_accuracy: 0.1821
Epoch 25/30	6s	4ms/step	loss: 2.1416	sparse_categorical_accuracy: 0.1702	val_loss: 2.1592	val_sparse_categorical_accuracy: 0.1617
Epoch 26/30	4s	3ms/step	loss: 2.1183	sparse_categorical_accuracy: 0.1732	val_loss: 2.0058	val_sparse_categorical_accuracy: 0.1802
Epoch 27/30	3s	3ms/step	loss: 2.0977	sparse_categorical_accuracy: 0.1778	val_loss: 2.1471	val_sparse_categorical_accuracy: 0.2095
Epoch 28/30	3s	3ms/step	loss: 2.0482	sparse_categorical_accuracy: 0.1829	val_loss: 2.0955	val_sparse_categorical_accuracy: 0.1554
Epoch 29/30	4s	5ms/step	loss: 2.1867	sparse_categorical_accuracy: 0.1793	val_loss: 2.0906	val_sparse_categorical_accuracy: 0.1877
Epoch 30/30	3s	3ms/step	loss: 2.0997	sparse_categorical_accuracy: 0.1825	val_loss: 2.0616	val_sparse_categorical_accuracy: 0.1836

## הרצה מספר 13:

Epoch 1/50	14s	7ms/step	loss: 1.0249	sparse_categorical_accuracy: 0.6821	val_loss: 0.6407	val_sparse_categorical_accuracy: 0.8244
Epoch 2/50	10s	4ms/step	loss: 0.6829	sparse_categorical_accuracy: 0.8085	val_loss: 0.8705	val_sparse_categorical_accuracy: 0.7346
Epoch 3/50	3s	4ms/step	loss: 0.7292	sparse_categorical_accuracy: 0.7867	val_loss: 0.8657	val_sparse_categorical_accuracy: 0.7311
Epoch 4/50	2s	5ms/step	loss: 0.8273	sparse_categorical_accuracy: 0.7508	val_loss: 0.7466	val_sparse_categorical_accuracy: 0.7767
Epoch 5/50	3s	6ms/step	loss: 0.7750	sparse_categorical_accuracy: 0.7672	val_loss: 0.9544	val_sparse_categorical_accuracy: 0.6849
Epoch 6/50	4s	4ms/step	loss: 0.7975	sparse_categorical_accuracy: 0.7583	val_loss: 0.7509	val_sparse_categorical_accuracy: 0.7821
Epoch 7/50	2s	4ms/step	loss: 0.8009	sparse_categorical_accuracy: 0.7577	val_loss: 0.9497	val_sparse_categorical_accuracy: 0.7197
Epoch 8/50	2s	4ms/step	loss: 0.9337	sparse_categorical_accuracy: 0.6850	val_loss: 1.0837	val_sparse_categorical_accuracy: 0.6392
Epoch 9/50	3s	5ms/step	loss: 1.0416	sparse_categorical_accuracy: 0.6513	val_loss: 0.8911	val_sparse_categorical_accuracy: 0.7268
Epoch 10/50	5s	4ms/step	loss: 0.9252	sparse_categorical_accuracy: 0.6918	val_loss: 0.8527	val_sparse_categorical_accuracy: 0.6879
Epoch 11/50	2s	4ms/step	loss: 0.9085	sparse_categorical_accuracy: 0.7010	val_loss: 0.9846	val_sparse_categorical_accuracy: 0.6614
Epoch 12/50	2s	4ms/step	loss: 0.9455	sparse_categorical_accuracy: 0.6911	val_loss: 0.8542	val_sparse_categorical_accuracy: 0.7395
Epoch 13/50	3s	4ms/step	loss: 0.8375	sparse_categorical_accuracy: 0.7375	val_loss: 0.8788	val_sparse_categorical_accuracy: 0.7190
Epoch 14/50	3s	7ms/step	loss: 0.8168	sparse_categorical_accuracy: 0.7438	val_loss: 0.8332	val_sparse_categorical_accuracy: 0.7307
Epoch 15/50	4s	4ms/step	loss: 0.8693	sparse_categorical_accuracy: 0.7191	val_loss: 0.8448	val_sparse_categorical_accuracy: 0.7056
Epoch 16/50	3s	4ms/step	loss: 0.8651	sparse_categorical_accuracy: 0.7057	val_loss: 0.8542	val_sparse_categorical_accuracy: 0.7040
Epoch 17/50	3s	4ms/step	loss: 0.8818	sparse_categorical_accuracy: 0.6925	val_loss: 0.9560	val_sparse_categorical_accuracy: 0.7074
Epoch 18/50	2s	5ms/step	loss: 1.0214	sparse_categorical_accuracy: 0.6726	val_loss: 1.0631	val_sparse_categorical_accuracy: 0.6722
Epoch 19/50	3s	6ms/step	loss: 1.0044	sparse_categorical_accuracy: 0.6644	val_loss: 0.9524	val_sparse_categorical_accuracy: 0.6876
Epoch 20/50	4s	4ms/step	loss: 1.0245	sparse_categorical_accuracy: 0.6668	val_loss: 0.9864	val_sparse_categorical_accuracy: 0.6793
Epoch 21/50	2s	4ms/step	loss: 0.9532	sparse_categorical_accuracy: 0.6943	val_loss: 0.8593	val_sparse_categorical_accuracy: 0.7296
Epoch 22/50	3s	4ms/step	loss: 0.9153	sparse_categorical_accuracy: 0.7038	val_loss: 0.9364	val_sparse_categorical_accuracy: 0.6799
Epoch 23/50	4s	7ms/step	loss: 0.9216	sparse_categorical_accuracy: 0.6960	val_loss: 0.8630	val_sparse_categorical_accuracy: 0.7404
Epoch 24/50	2s	4ms/step	loss: 0.8849	sparse_categorical_accuracy: 0.7267	val_loss: 0.8063	val_sparse_categorical_accuracy: 0.7391
Epoch 25/50	7s	6ms/step	loss: 0.8450	sparse_categorical_accuracy: 0.7330	val_loss: 0.8808	val_sparse_categorical_accuracy: 0.7035

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469/469 — 2s 4ms/step - loss: 0.8450 - sparse_categorical_accuracy: 0.7339 - val_loss: 0.8898 - val_sparse_categorical_accuracy: 0.7035
Epoch 26/50
469/469 — 2s 4ms/step - loss: 0.8861 - sparse_categorical_accuracy: 0.7193 - val_loss: 0.8115 - val_sparse_categorical_accuracy: 0.7371
Epoch 27/50
469/469 — 2s 4ms/step - loss: 0.9153 - sparse_categorical_accuracy: 0.6939 - val_loss: 1.0035 - val_sparse_categorical_accuracy: 0.6537
Epoch 28/50
469/469 — 2s 5ms/step - loss: 1.0493 - sparse_categorical_accuracy: 0.6407 - val_loss: 0.9575 - val_sparse_categorical_accuracy: 0.6815
Epoch 29/50
469/469 — 3s 7ms/step - loss: 1.0604 - sparse_categorical_accuracy: 0.6432 - val_loss: 1.2841 - val_sparse_categorical_accuracy: 0.4923
Epoch 30/50
469/469 — 2s 4ms/step - loss: 1.2142 - sparse_categorical_accuracy: 0.5673 - val_loss: 1.1362 - val_sparse_categorical_accuracy: 0.5852
Epoch 31/50
469/469 — 3s 4ms/step - loss: 1.2027 - sparse_categorical_accuracy: 0.5768 - val_loss: 1.1425 - val_sparse_categorical_accuracy: 0.5754
Epoch 32/50
469/469 — 2s 4ms/step - loss: 1.1413 - sparse_categorical_accuracy: 0.5877 - val_loss: 1.0592 - val_sparse_categorical_accuracy: 0.6432
Epoch 33/50
469/469 — 3s 4ms/step - loss: 1.1144 - sparse_categorical_accuracy: 0.6286 - val_loss: 1.0559 - val_sparse_categorical_accuracy: 0.6525
Epoch 34/50
469/469 — 3s 5ms/step - loss: 1.0972 - sparse_categorical_accuracy: 0.6283 - val_loss: 1.0467 - val_sparse_categorical_accuracy: 0.6591
Epoch 35/50
469/469 — 4s 4ms/step - loss: 1.0428 - sparse_categorical_accuracy: 0.6657 - val_loss: 1.0688 - val_sparse_categorical_accuracy: 0.6488
Epoch 36/50
469/469 — 2s 4ms/step - loss: 1.1333 - sparse_categorical_accuracy: 0.6246 - val_loss: 1.0131 - val_sparse_categorical_accuracy: 0.6575
Epoch 37/50
469/469 — 2s 4ms/step - loss: 1.1190 - sparse_categorical_accuracy: 0.6217 - val_loss: 1.1460 - val_sparse_categorical_accuracy: 0.6260
Epoch 38/50
469/469 — 3s 5ms/step - loss: 1.2392 - sparse_categorical_accuracy: 0.5898 - val_loss: 1.1433 - val_sparse_categorical_accuracy: 0.6110
Epoch 39/50
469/469 — 3s 6ms/step - loss: 1.1530 - sparse_categorical_accuracy: 0.6053 - val_loss: 1.1525 - val_sparse_categorical_accuracy: 0.6012
Epoch 40/50
469/469 — 2s 4ms/step - loss: 1.1706 - sparse_categorical_accuracy: 0.6138 - val_loss: 1.1035 - val_sparse_categorical_accuracy: 0.6507
Epoch 41/50
469/469 — 2s 4ms/step - loss: 1.1238 - sparse_categorical_accuracy: 0.6339 - val_loss: 0.9531 - val_sparse_categorical_accuracy: 0.7048
Epoch 42/50
469/469 — 2s 4ms/step - loss: 1.0728 - sparse_categorical_accuracy: 0.6279 - val_loss: 1.1118 - val_sparse_categorical_accuracy: 0.6091
Epoch 43/50
469/469 — 3s 4ms/step - loss: 1.0896 - sparse_categorical_accuracy: 0.6193 - val_loss: 0.9957 - val_sparse_categorical_accuracy: 0.6635
Epoch 44/50
469/469 — 3s 6ms/step - loss: 1.0545 - sparse_categorical_accuracy: 0.6298 - val_loss: 1.0278 - val_sparse_categorical_accuracy: 0.6292
Epoch 45/50
469/469 — 3s 5ms/step - loss: 1.0126 - sparse_categorical_accuracy: 0.6510 - val_loss: 0.9674 - val_sparse_categorical_accuracy: 0.6765
Epoch 46/50
469/469 — 4s 4ms/step - loss: 1.0313 - sparse_categorical_accuracy: 0.6472 - val_loss: 1.0901 - val_sparse_categorical_accuracy: 0.6395
Epoch 47/50
469/469 — 2s 4ms/step - loss: 1.1049 - sparse_categorical_accuracy: 0.6446 - val_loss: 1.0942 - val_sparse_categorical_accuracy: 0.6504
Epoch 48/50
469/469 — 2s 4ms/step - loss: 1.1236 - sparse_categorical_accuracy: 0.6060 - val_loss: 1.0824 - val_sparse_categorical_accuracy: 0.6250
Epoch 49/50
469/469 — 3s 6ms/step - loss: 1.1060 - sparse_categorical_accuracy: 0.6143 - val_loss: 1.0111 - val_sparse_categorical_accuracy: 0.6431
Epoch 50/50
469/469 — 2s 5ms/step - loss: 1.0506 - sparse_categorical_accuracy: 0.6412 - val_loss: 1.0253 - val_sparse_categorical_accuracy: 0.6665

```

הרצה מספר 14:

```

Epoch 1/25
469/469 — 14s 7ms/step - loss: 0.9265 - sparse_categorical_accuracy: 0.7044 - val_loss: 0.7374 - val_sparse_categorical_accuracy: 0.7873
Epoch 2/25
469/469 — 10s 4ms/step - loss: 0.7193 - sparse_categorical_accuracy: 0.7896 - val_loss: 0.6538 - val_sparse_categorical_accuracy: 0.8148
Epoch 3/25
469/469 — 2s 4ms/step - loss: 0.7799 - sparse_categorical_accuracy: 0.7686 - val_loss: 1.0085 - val_sparse_categorical_accuracy: 0.7001
Epoch 4/25
469/469 — 2s 4ms/step - loss: 0.8831 - sparse_categorical_accuracy: 0.7387 - val_loss: 0.8128 - val_sparse_categorical_accuracy: 0.7515
Epoch 5/25
469/469 — 2s 4ms/step - loss: 0.8314 - sparse_categorical_accuracy: 0.7506 - val_loss: 0.7778 - val_sparse_categorical_accuracy: 0.7714
Epoch 6/25
469/469 — 3s 5ms/step - loss: 0.8810 - sparse_categorical_accuracy: 0.7361 - val_loss: 0.9811 - val_sparse_categorical_accuracy: 0.6872
Epoch 7/25
469/469 — 3s 6ms/step - loss: 0.9976 - sparse_categorical_accuracy: 0.6947 - val_loss: 0.8734 - val_sparse_categorical_accuracy: 0.7489
Epoch 8/25
469/469 — 4s 4ms/step - loss: 0.9067 - sparse_categorical_accuracy: 0.7332 - val_loss: 0.8800 - val_sparse_categorical_accuracy: 0.6987
Epoch 9/25
469/469 — 2s 4ms/step - loss: 0.9688 - sparse_categorical_accuracy: 0.6937 - val_loss: 0.8658 - val_sparse_categorical_accuracy: 0.7228
Epoch 10/25
469/469 — 2s 4ms/step - loss: 0.9793 - sparse_categorical_accuracy: 0.6898 - val_loss: 0.9693 - val_sparse_categorical_accuracy: 0.6847
Epoch 11/25
469/469 — 2s 4ms/step - loss: 0.9843 - sparse_categorical_accuracy: 0.6774 - val_loss: 0.8210 - val_sparse_categorical_accuracy: 0.7451
Epoch 12/25
469/469 — 3s 6ms/step - loss: 0.9071 - sparse_categorical_accuracy: 0.7284 - val_loss: 0.9311 - val_sparse_categorical_accuracy: 0.6880
Epoch 13/25
469/469 — 2s 4ms/step - loss: 0.9504 - sparse_categorical_accuracy: 0.7074 - val_loss: 0.8570 - val_sparse_categorical_accuracy: 0.7586
Epoch 14/25
469/469 — 2s 4ms/step - loss: 0.9435 - sparse_categorical_accuracy: 0.7129 - val_loss: 0.8092 - val_sparse_categorical_accuracy: 0.7597
Epoch 15/25
469/469 — 2s 4ms/step - loss: 0.9592 - sparse_categorical_accuracy: 0.7044 - val_loss: 0.9513 - val_sparse_categorical_accuracy: 0.6896
Epoch 16/25
469/469 — 2s 4ms/step - loss: 0.9738 - sparse_categorical_accuracy: 0.6784 - val_loss: 0.8417 - val_sparse_categorical_accuracy: 0.7289
Epoch 17/25
469/469 — 3s 5ms/step - loss: 0.8907 - sparse_categorical_accuracy: 0.7148 - val_loss: 0.9057 - val_sparse_categorical_accuracy: 0.7195
Epoch 18/25
469/469 — 3s 6ms/step - loss: 0.9531 - sparse_categorical_accuracy: 0.6994 - val_loss: 0.9300 - val_sparse_categorical_accuracy: 0.6965
Epoch 19/25
469/469 — 4s 4ms/step - loss: 0.9867 - sparse_categorical_accuracy: 0.6847 - val_loss: 0.8607 - val_sparse_categorical_accuracy: 0.7061
Epoch 20/25
469/469 — 3s 4ms/step - loss: 0.8908 - sparse_categorical_accuracy: 0.7304 - val_loss: 0.8293 - val_sparse_categorical_accuracy: 0.7456
Epoch 21/25
469/469 — 2s 4ms/step - loss: 0.8658 - sparse_categorical_accuracy: 0.7365 - val_loss: 0.8459 - val_sparse_categorical_accuracy: 0.7347
Epoch 22/25
469/469 — 3s 5ms/step - loss: 0.8896 - sparse_categorical_accuracy: 0.7299 - val_loss: 0.8415 - val_sparse_categorical_accuracy: 0.7452
Epoch 23/25
469/469 — 4s 4ms/step - loss: 0.9831 - sparse_categorical_accuracy: 0.6860 - val_loss: 0.9111 - val_sparse_categorical_accuracy: 0.6981
Epoch 24/25
469/469 — 2s 4ms/step - loss: 1.0026 - sparse_categorical_accuracy: 0.6716 - val_loss: 0.8890 - val_sparse_categorical_accuracy: 0.7159
Epoch 25/25
469/469 — 2s 4ms/step - loss: 0.9918 - sparse_categorical_accuracy: 0.6867 - val_loss: 1.0364 - val_sparse_categorical_accuracy: 0.6751

```



הרצה מספר 15 :



```
15s 10ms/step - loss: 1.4154 - sparse_categorical_accuracy: 0.4657 - val_loss: 0.6146 - val_sparse_categorical_accuracy: 0.833
2s 4ms/step - loss: 0.7822 - sparse_categorical_accuracy: 0.7684 - val_loss: 0.5467 - val_sparse_categorical_accuracy: 0.8757
2s 4ms/step - loss: 0.6867 - sparse_categorical_accuracy: 0.8072 - val_loss: 0.6299 - val_sparse_categorical_accuracy: 0.8388
3s 4ms/step - loss: 0.6914 - sparse_categorical_accuracy: 0.8110 - val_loss: 0.5055 - val_sparse_categorical_accuracy: 0.8999
2s 5ms/step - loss: 0.6695 - sparse_categorical_accuracy: 0.8266 - val_loss: 0.5272 - val_sparse_categorical_accuracy: 0.8890
3s 6ms/step - loss: 0.6370 - sparse_categorical_accuracy: 0.8294 - val_loss: 0.5337 - val_sparse_categorical_accuracy: 0.8927
2s 4ms/step - loss: 0.5974 - sparse_categorical_accuracy: 0.8457 - val_loss: 0.4891 - val_sparse_categorical_accuracy: 0.8972
3s 4ms/step - loss: 0.6239 - sparse_categorical_accuracy: 0.8418 - val_loss: 0.5026 - val_sparse_categorical_accuracy: 0.8947
2s 4ms/step - loss: 0.6182 - sparse_categorical_accuracy: 0.8409 - val_loss: 0.5487 - val_sparse_categorical_accuracy: 0.8634
3s 4ms/step - loss: 0.5840 - sparse_categorical_accuracy: 0.8472 - val_loss: 0.5078 - val_sparse_categorical_accuracy: 0.8832
3s 6ms/step - loss: 0.5753 - sparse_categorical_accuracy: 0.8517 - val_loss: 0.5277 - val_sparse_categorical_accuracy: 0.8999
4s 4ms/step - loss: 0.5711 - sparse_categorical_accuracy: 0.8550 - val_loss: 0.4542 - val_sparse_categorical_accuracy: 0.9042
3s 4ms/step - loss: 0.5365 - sparse_categorical_accuracy: 0.8612 - val_loss: 0.4676 - val_sparse_categorical_accuracy: 0.9067
2s 4ms/step - loss: 0.5731 - sparse_categorical_accuracy: 0.8534 - val_loss: 0.5180 - val_sparse_categorical_accuracy: 0.8886
2s 4ms/step - loss: 0.5639 - sparse_categorical_accuracy: 0.8574 - val_loss: 0.5174 - val_sparse_categorical_accuracy: 0.8935
```

עשיתי עבור רשת נוירונים 18,35,99,40

שיר כורשיד 318359940