**Model Outputs**

**VGG-16 Model with Preprocessing:**

Epoch 1/20

2/2 [==============================] - 65s 33s/step - loss: 6.8387 - acc: 0.0391 - val\_loss: 7.5160 - val\_acc: 0.0469

Epoch 2/20

2/2 [==============================] - 65s 33s/step - loss: 8.5191 - acc: 0.0391 - val\_loss: 4.6489 - val\_acc: 0.1016

Epoch 3/20

2/2 [==============================] - 65s 33s/step - loss: 5.2055 - acc: 0.0391 - val\_loss: 3.5715 - val\_acc: 0.0977

Epoch 4/20

2/2 [==============================] - 65s 33s/step - loss: 3.9227 - acc: 0.0781 - val\_loss: 3.1036 - val\_acc: 0.1328

Epoch 5/20

2/2 [==============================] - 65s 33s/step - loss: 3.4891 - acc: 0.0703 - val\_loss: 2.9631 - val\_acc: 0.1992

Epoch 6/20

2/2 [==============================] - 65s 33s/step - loss: 3.0535 - acc: 0.0938 - val\_loss: 2.8051 - val\_acc: 0.2969

Epoch 7/20

2/2 [==============================] - 65s 33s/step - loss: 2.9847 - acc: 0.1875 - val\_loss: 2.7608 - val\_acc: 0.2617

Epoch 8/20

2/2 [==============================] - 59s 29s/step - loss: 3.0158 - acc: 0.1847 - val\_loss: 2.7295 - val\_acc: 0.2969

Epoch 9/20

2/2 [==============================] - 66s 33s/step - loss: 2.8685 - acc: 0.1719 - val\_loss: 2.6275 - val\_acc: 0.2852

Epoch 10/20

2/2 [==============================] - 66s 33s/step - loss: 2.6277 - acc: 0.2422 - val\_loss: 2.5799 - val\_acc: 0.3672

Epoch 11/20

2/2 [==============================] - 65s 33s/step - loss: 2.6228 - acc: 0.2734 - val\_loss: 2.4519 - val\_acc: 0.3984

Epoch 12/20

2/2 [==============================] - 65s 33s/step - loss: 2.3739 - acc: 0.3047 - val\_loss: 2.3215 - val\_acc: 0.4414

Epoch 13/20

2/2 [==============================] - 65s 33s/step - loss: 2.2897 - acc: 0.3828 - val\_loss: 2.2490 - val\_acc: 0.4531

Epoch 14/20

2/2 [==============================] - 59s 29s/step - loss: 2.1902 - acc: 0.3523 - val\_loss: 2.7899 - val\_acc: 0.2344

Epoch 15/20

2/2 [==============================] - 65s 33s/step - loss: 2.7024 - acc: 0.2656 - val\_loss: 2.3417 - val\_acc: 0.3828

Epoch 16/20

2/2 [==============================] - 65s 33s/step - loss: 2.6934 - acc: 0.2812 - val\_loss: 2.2873 - val\_acc: 0.4062

Epoch 17/20

2/2 [==============================] - 66s 33s/step - loss: 2.0951 - acc: 0.4297 - val\_loss: 1.9755 - val\_acc: 0.5625

Epoch 18/20

2/2 [==============================] - 66s 33s/step - loss: 1.8229 - acc: 0.5000 - val\_loss: 2.0541 - val\_acc: 0.4492

Epoch 19/20

2/2 [==============================] - 65s 33s/step - loss: 1.8276 - acc: 0.5391 - val\_loss: 2.0379 - val\_acc: 0.4492

Epoch 20/20

2/2 [==============================] - 66s 33s/step - loss: 1.7284 - acc: 0.4531 - val\_loss: 1.8152 - val\_acc: 0.5547

**VGG-16 Model without preprocessing**

Epoch 1/20

2/2 [==============================] - 51s 25s/step - loss: 6.7399 - acc: 0.0358 - val\_loss: 6.3781 - val\_acc: 0.0338

Epoch 2/20

2/2 [==============================] - 57s 29s/step - loss: 8.7021 - acc: 0.0547 - val\_loss: 4.6358 - val\_acc: 0.0773

Epoch 3/20

2/2 [==============================] - 57s 29s/step - loss: 6.2239 - acc: 0.0859 - val\_loss: 4.0742 - val\_acc: 0.0628

Epoch 4/20

2/2 [==============================] - 51s 25s/step - loss: 5.0649 - acc: 0.0358 - val\_loss: 3.3736 - val\_acc: 0.1643

Epoch 5/20

2/2 [==============================] - 57s 29s/step - loss: 3.7732 - acc: 0.0781 - val\_loss: 2.9665 - val\_acc: 0.1981

Epoch 6/20

2/2 [==============================] - 57s 29s/step - loss: 3.0603 - acc: 0.1953 - val\_loss: 3.0280 - val\_acc: 0.1787

Epoch 7/20

2/2 [==============================] - 58s 29s/step - loss: 2.7908 - acc: 0.2656 - val\_loss: 2.8963 - val\_acc: 0.1836

Epoch 8/20

2/2 [==============================] - 58s 29s/step - loss: 2.4898 - acc: 0.2734 - val\_loss: 2.8839 - val\_acc: 0.2174

Epoch 9/20

2/2 [==============================] - 57s 29s/step - loss: 2.8626 - acc: 0.1953 - val\_loss: 2.9871 - val\_acc: 0.2319

Epoch 10/20

2/2 [==============================] - 51s 25s/step - loss: 2.9401 - acc: 0.1749 - val\_loss: 2.9294 - val\_acc: 0.2126

Epoch 11/20

2/2 [==============================] - 51s 25s/step - loss: 2.6315 - acc: 0.2872 - val\_loss: 2.8575 - val\_acc: 0.1787

Epoch 12/20

2/2 [==============================] - 58s 29s/step - loss: 2.4353 - acc: 0.3047 - val\_loss: 2.7042 - val\_acc: 0.2705

Epoch 13/20

2/2 [==============================] - 58s 29s/step - loss: 2.3734 - acc: 0.3438 - val\_loss: 2.7103 - val\_acc: 0.2415

Epoch 14/20

2/2 [==============================] - 58s 29s/step - loss: 2.2588 - acc: 0.3438 - val\_loss: 2.8468 - val\_acc: 0.1932

Epoch 15/20

2/2 [==============================] - 57s 29s/step - loss: 2.4091 - acc: 0.2969 - val\_loss: 2.5747 - val\_acc: 0.3092

Epoch 16/20

2/2 [==============================] - 57s 29s/step - loss: 1.9369 - acc: 0.4844 - val\_loss: 2.5791 - val\_acc: 0.2899

Epoch 17/20

2/2 [==============================] - 51s 25s/step - loss: 1.9057 - acc: 0.4736 - val\_loss: 2.5162 - val\_acc: 0.2754

Epoch 18/20

2/2 [==============================] - 58s 29s/step - loss: 2.1794 - acc: 0.4062 - val\_loss: 2.6654 - val\_acc: 0.2947

Epoch 19/20

2/2 [==============================] - 51s 25s/step - loss: 1.7639 - acc: 0.5679 - val\_loss: 2.5684 - val\_acc: 0.3382

Epoch 20/20

2/2 [==============================] - 57s 29s/step - loss: 1.9007 - acc: 0.4453 - val\_loss: 2.3700 - val\_acc: 0.3527

**Basic CNN model output (without preprocessing)**

Epoch 1/20

3/3 [==============================] - 2s 723ms/step - loss: 6.0860 - acc: 0.0341 - val\_loss: 3.6784 - val\_acc: 0.0350

Epoch 2/20

3/3 [==============================] - 3s 881ms/step - loss: 3.7399 - acc: 0.0312 - val\_loss: 3.4141 - val\_acc: 0.0420

Epoch 3/20

3/3 [==============================] - 3s 902ms/step - loss: 3.4615 - acc: 0.0312 - val\_loss: 3.3982 - val\_acc: 0.0629

Epoch 4/20

3/3 [==============================] - 3s 899ms/step - loss: 3.4528 - acc: 0.0417 - val\_loss: 3.3939 - val\_acc: 0.0559

Epoch 5/20

3/3 [==============================] - 3s 914ms/step - loss: 3.3781 - acc: 0.1022 - val\_loss: 3.3894 - val\_acc: 0.0350

Epoch 6/20

3/3 [==============================] - 3s 906ms/step - loss: 3.3634 - acc: 0.0521 - val\_loss: 3.3850 - val\_acc: 0.0699

Epoch 7/20

3/3 [==============================] - 3s 904ms/step - loss: 3.3663 - acc: 0.0938 - val\_loss: 3.3774 - val\_acc: 0.0559

Epoch 8/20

3/3 [==============================] - 3s 904ms/step - loss: 3.3230 - acc: 0.0833 - val\_loss: 3.3642 - val\_acc: 0.0559

Epoch 9/20

3/3 [==============================] - 3s 947ms/step - loss: 3.3444 - acc: 0.0729 - val\_loss: 3.3567 - val\_acc: 0.0629

Epoch 10/20

3/3 [==============================] - 3s 869ms/step - loss: 3.2844 - acc: 0.1684 - val\_loss: 3.3864 - val\_acc: 0.0350

Epoch 11/20

3/3 [==============================] - 3s 903ms/step - loss: 3.2924 - acc: 0.0833 - val\_loss: 3.3256 - val\_acc: 0.0490

Epoch 12/20

3/3 [==============================] - 3s 898ms/step - loss: 3.2532 - acc: 0.0833 - val\_loss: 3.3014 - val\_acc: 0.0769

Epoch 13/20

3/3 [==============================] - 3s 941ms/step - loss: 3.2220 - acc: 0.1250 - val\_loss: 3.3034 - val\_acc: 0.0559

Epoch 14/20

3/3 [==============================] - 3s 879ms/step - loss: 3.2163 - acc: 0.0469 - val\_loss: 3.2875 - val\_acc: 0.1049

Epoch 15/20

3/3 [==============================] - 3s 908ms/step - loss: 3.0223 - acc: 0.2083 - val\_loss: 3.2177 - val\_acc: 0.0839

Epoch 16/20

3/3 [==============================] - 3s 909ms/step - loss: 3.0463 - acc: 0.1354 - val\_loss: 3.2110 - val\_acc: 0.0909

Epoch 17/20

3/3 [==============================] - 3s 911ms/step - loss: 3.0700 - acc: 0.1562 - val\_loss: 3.1946 - val\_acc: 0.0979

Epoch 18/20

3/3 [==============================] - 3s 951ms/step - loss: 2.9328 - acc: 0.1458 - val\_loss: 3.1959 - val\_acc: 0.0979

Epoch 19/20

3/3 [==============================] - 3s 900ms/step - loss: 2.9068 - acc: 0.2188 - val\_loss: 3.1641 - val\_acc: 0.1189

Epoch 20/20

3/3 [==============================] - 3s 904ms/step - loss: 2.7281 - acc: 0.2917 - val\_loss: 3.1544 - val\_acc: 0.1049

**Basic CNN model output (preprocessing done)**

Epoch 1/20

3/3 [==============================] - 3s 1s/step - loss: 3.2635 - acc: 0.0938 - val\_loss: 3.2075 - val\_acc: 0.1125

Epoch 2/20

3/3 [==============================] - 3s 942ms/step - loss: 3.1976 - acc: 0.1084 - val\_loss: 3.1535 - val\_acc: 0.1562

Epoch 3/20

3/3 [==============================] - 3s 988ms/step - loss: 3.2332 - acc: 0.1458 - val\_loss: 3.1724 - val\_acc: 0.1062

Epoch 4/20

3/3 [==============================] - 3s 986ms/step - loss: 3.0524 - acc: 0.1562 - val\_loss: 3.1251 - val\_acc: 0.1000

Epoch 5/20

3/3 [==============================] - 3s 980ms/step - loss: 3.1286 - acc: 0.1458 - val\_loss: 3.0512 - val\_acc: 0.1500

Epoch 6/20

3/3 [==============================] - 3s 985ms/step - loss: 3.1332 - acc: 0.1771 - val\_loss: 3.0888 - val\_acc: 0.1938

Epoch 7/20

3/3 [==============================] - 3s 980ms/step - loss: 2.9530 - acc: 0.2396 - val\_loss: 2.9881 - val\_acc: 0.2188

Epoch 8/20

3/3 [==============================] - 3s 980ms/step - loss: 2.9750 - acc: 0.1562 - val\_loss: 2.9804 - val\_acc: 0.2000

Epoch 9/20

3/3 [==============================] - 3s 973ms/step - loss: 2.8725 - acc: 0.1562 - val\_loss: 2.9059 - val\_acc: 0.2687

Epoch 10/20

3/3 [==============================] - 3s 969ms/step - loss: 2.9239 - acc: 0.1250 - val\_loss: 2.9072 - val\_acc: 0.2437

Epoch 11/20

3/3 [==============================] - 3s 1s/step - loss: 2.9126 - acc: 0.2188 - val\_loss: 2.8347 - val\_acc: 0.2938

Epoch 12/20

3/3 [==============================] - 3s 987ms/step - loss: 2.6884 - acc: 0.2604 - val\_loss: 2.7381 - val\_acc: 0.3063

Epoch 13/20

3/3 [==============================] - 3s 984ms/step - loss: 2.6370 - acc: 0.2396 - val\_loss: 2.8392 - val\_acc: 0.2562

Epoch 14/20

3/3 [==============================] - 3s 989ms/step - loss: 2.5866 - acc: 0.2396 - val\_loss: 2.8166 - val\_acc: 0.2250

Epoch 15/20

3/3 [==============================] - 3s 988ms/step - loss: 2.6403 - acc: 0.2396 - val\_loss: 2.7538 - val\_acc: 0.2437

Epoch 16/20

3/3 [==============================] - 3s 988ms/step - loss: 2.4440 - acc: 0.3229 - val\_loss: 2.7164 - val\_acc: 0.2125

Epoch 17/20

3/3 [==============================] - 3s 991ms/step - loss: 2.4694 - acc: 0.3229 - val\_loss: 2.6251 - val\_acc: 0.2812

Epoch 18/20

3/3 [==============================] - 3s 989ms/step - loss: 2.5268 - acc: 0.3229 - val\_loss: 2.6501 - val\_acc: 0.3187

Epoch 19/20

3/3 [==============================] - 3s 982ms/step - loss: 2.5165 - acc: 0.2500 - val\_loss: 2.5870 - val\_acc: 0.3500

Epoch 20/20

3/3 [==============================] - 3s 981ms/step - loss: 2.3287 - acc: 0.3750 - val\_loss: 2.5203 - val\_acc: 0.2938