```
C:\Users\Asus\AppData\Local\Microsoft\WindowsApps\python3.10.exe C:\Users\Asus\Documents\tumor\main.py
2025-03-30 16:15:13.864960: I tensorflow/core/util/port.cc:113] oneDNN custom operations are on. You may see slightly different numerical results due to floating-point round-off errors from different computation orders. To turn them off, set the environment variable `TF_ENABLE_ONEDNN_OPTS=0`.
WARNING:tensorflow:From C:\Users\Asus\AppData\Local\Packages\PythonSoftwareFoundation.Python.3.10_qbz5n2kfra8p0\LocalCache\local-packages\Python310\site-packages\keras\src\losses.py:2976: The name tf.losses.sparse_softmax_cross_entropy is deprecated. Please use tf.compat.v1.losses.sparse_softmax_cross_entropy instead.

TensorFlow Version: 2.15.0
No GPU found. Running on CPU.
Training
Number of Paths: 5712
Number of Labels: 5712

Testing
Number of Paths: 1311
Number of Labels: 1311
2025-03-30 16:15:18.281438: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized to use available CPU instructions in performance-critical operations.
To enable the following instructions: SSE SSE2 SSE3 SSE4.1 SSE4.2 AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler flags.

Training dataset: <_PrefetchDataset element_spec=(TensorSpec(shape=(None, 168, 168, 1), dtype=tf.float32, name=None), TensorSpec(shape=(None,), dtype=tf.int32, name=None))>

Testing dataset: <_PrefetchDataset element_spec=(TensorSpec(shape=(None, 168, 168, 1), dtype=tf.float32, name=None), TensorSpec(shape=(None,), dtype=
```

```
19 tf.int32, name=None))>
20 WARNING:tensorflow:From C:\Users\Asus\AppData\Local\
   Packages\PythonSoftwareFoundation.Python.3.
   10_qbz5n2kfra8p0\LocalCache\local-packages\Python310\
   site-packages\keras\src\backend.py:873: The name tf.
   get_default_graph is deprecated. Please use tf.compat
   .v1.get_default_graph instead.
21
22 Number of Classes: 4
23 Image shape: (168, 168, 1)
24 Epochs: 50
25 Batch size: 32
26 WARNING:tensorflow:From C:\Users\Asus\AppData\Local\
   Packages\PythonSoftwareFoundation.Python.3.
   10_qbz5n2kfra8p0\LocalCache\local-packages\Python310\
   site-packages\keras\src\layers\pooling\max_pooling2d.
   py:161: The name tf.nn.max_pool is deprecated. Please
    use tf.nn.max_pool2d instead.
27
28 Model: "sequential_1"
29 _________________________________________________
   _____________
30  Layer (type)                Output Shape
                Param #
31 =================================================
   =============
32  conv2d (Conv2D)             (None, 164, 164, 64
   )      1664
33
34  max_pooling2d (MaxPooling2  (None, 54, 54, 64
   )        0
35  D
   )

36

37  conv2d_1 (Conv2D)           (None, 50, 50, 64
   )        102464
38
```

```
39  max_pooling2d_1 (MaxPoolin  (None, 16, 16, 64
   )         0
40  g2D
   )

41

42  conv2d_2 (Conv2D)           (None, 13, 13, 128
   )        131200
43

44  max_pooling2d_2 (MaxPoolin  (None, 6, 6, 128
   )          0
45  g2D
   )

46

47  conv2d_3 (Conv2D)           (None, 3, 3, 128
   )          262272
48

49  max_pooling2d_3 (MaxPoolin  (None, 1, 1, 128
   )          0
50  g2D
   )

51

52  flatten (Flatten)           (None, 128
   )                0
53

54  dense (Dense)               (None, 512
   )               66048
55

56  dense_1 (Dense)             (None, 4
   )                  2052
57
```

```
58 =================================================================
   ============
59 Total params: 565700 (2.16 MB)
60 Trainable params: 565700 (2.16 MB)
61 Non-trainable params: 0 (0.00 Byte)
62 _________________________________________________________________
   ____________
63 Epoch 1/50
64 WARNING:tensorflow:From C:\Users\Asus\AppData\Local\
   Packages\PythonSoftwareFoundation.Python.3.
   10_qbz5n2kfra8p0\LocalCache\local-packages\Python310\
   site-packages\keras\src\utils\tf_utils.py:492: The
   name tf.ragged.RaggedTensorValue is deprecated.
   Please use tf.compat.v1.ragged.RaggedTensorValue
   instead.
65
66 WARNING:tensorflow:From C:\Users\Asus\AppData\Local\
   Packages\PythonSoftwareFoundation.Python.3.
   10_qbz5n2kfra8p0\LocalCache\local-packages\Python310\
   site-packages\keras\src\engine\base_layer_utils.py:
   384: The name tf.executing_eagerly_outside_functions
   is deprecated. Please use tf.compat.v1.
   executing_eagerly_outside_functions instead.
67
68 179/179 [==============================] - 104s 575ms
   /step - loss: 0.8749 - accuracy: 0.6275 - val_loss: 0
   .6907 - val_accuracy: 0.7216 - lr: 0.0010
69 Epoch 2/50
70 179/179 [==============================] - 158s 878ms
   /step - loss: 0.4569 - accuracy: 0.8258 - val_loss: 0
   .5035 - val_accuracy: 0.7910 - lr: 0.0010
71 Epoch 3/50
72 179/179 [==============================] - 138s 766ms
   /step - loss: 0.3277 - accuracy: 0.8776 - val_loss: 0
   .3309 - val_accuracy: 0.8848 - lr: 0.0010
73 Epoch 4/50
74 179/179 [==============================] - 97s 540ms/
   step - loss: 0.2597 - accuracy: 0.9056 - val_loss: 0.
   2937 - val_accuracy: 0.9008 - lr: 0.0010
75 Epoch 5/50
76 179/179 [==============================] - 138s 770ms
```

```
 76 /step - loss: 0.1965 - accuracy: 0.9286 - val_loss:
    0.3580 - val_accuracy: 0.8802 - lr: 0.0010
 77 Epoch 6/50
 78 179/179 [==============================] - 143s
    797ms/step - loss: 0.1641 - accuracy: 0.9380 -
    val_loss: 0.4571 - val_accuracy: 0.8749 - lr: 0.0010
 79 Epoch 7/50
 80 179/179 [==============================] - 139s
    775ms/step - loss: 0.1300 - accuracy: 0.9527 -
    val_loss: 0.2156 - val_accuracy: 0.9184 - lr: 0.0010
 81 Epoch 8/50
 82 179/179 [==============================] - 74s 412ms
    /step - loss: 0.1148 - accuracy: 0.9583 - val_loss:
    0.2021 - val_accuracy: 0.9291 - lr: 0.0010
 83 Epoch 9/50
 84 179/179 [==============================] - 73s 404ms
    /step - loss: 0.0950 - accuracy: 0.9652 - val_loss:
    0.1487 - val_accuracy: 0.9558 - lr: 0.0010
 85 Epoch 10/50
 86 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0816 - accuracy: 0.9704 - val_loss:
    0.1333 - val_accuracy: 0.9512 - lr: 0.0010
 87 Epoch 11/50
 88 179/179 [==============================] - 73s 405ms
    /step - loss: 0.0692 - accuracy: 0.9748 - val_loss:
    0.1972 - val_accuracy: 0.9497 - lr: 0.0010
 89 Epoch 12/50
 90 179/179 [==============================] - 73s 404ms
    /step - loss: 0.0757 - accuracy: 0.9748 - val_loss:
    0.0736 - val_accuracy: 0.9756 - lr: 0.0010
 91 Epoch 13/50
 92 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0569 - accuracy: 0.9823 - val_loss:
    0.2328 - val_accuracy: 0.9390 - lr: 0.0010
 93 Epoch 14/50
 94 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0632 - accuracy: 0.9811 - val_loss:
    0.1441 - val_accuracy: 0.9550 - lr: 0.0010
 95 Epoch 15/50
 96 179/179 [==============================] - 72s 401ms
    /step - loss: 0.0479 - accuracy: 0.9821 - val_loss:
```

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 96 0.1602 - val_accuracy: 0.9550 - lr: 0.0010
 97 Epoch 16/50
 98 179/179 [==============================] - 72s 403ms
    /step - loss: 0.0414 - accuracy: 0.9867 - val_loss:
    0.0864 - val_accuracy: 0.9725 - lr: 0.0010
 99 Epoch 17/50
100 179/179 [==============================] - 72s 400ms
    /step - loss: 0.0406 - accuracy: 0.9872 - val_loss:
    0.0604 - val_accuracy: 0.9802 - lr: 8.0000e-04
101 Epoch 18/50
102 179/179 [==============================] - 72s 399ms
    /step - loss: 0.0388 - accuracy: 0.9895 - val_loss:
    0.0964 - val_accuracy: 0.9680 - lr: 8.0000e-04
103 Epoch 19/50
104 179/179 [==============================] - 72s 399ms
    /step - loss: 0.0293 - accuracy: 0.9898 - val_loss:
    0.0994 - val_accuracy: 0.9725 - lr: 8.0000e-04
105 Epoch 20/50
106 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0384 - accuracy: 0.9884 - val_loss:
    0.1120 - val_accuracy: 0.9649 - lr: 8.0000e-04
107 Epoch 21/50
108 179/179 [==============================] - 71s 397ms
    /step - loss: 0.0281 - accuracy: 0.9900 - val_loss:
    0.1628 - val_accuracy: 0.9504 - lr: 8.0000e-04
109 Epoch 22/50
110 179/179 [==============================] - 80s 446ms
    /step - loss: 0.0177 - accuracy: 0.9953 - val_loss:
    0.0463 - val_accuracy: 0.9840 - lr: 6.4000e-04
111 Epoch 23/50
112 179/179 [==============================] - 94s 523ms
    /step - loss: 0.0194 - accuracy: 0.9933 - val_loss:
    0.1043 - val_accuracy: 0.9756 - lr: 6.4000e-04
113 Epoch 24/50
114 179/179 [==============================] - 127s
    710ms/step - loss: 0.0245 - accuracy: 0.9930 -
    val_loss: 0.1374 - val_accuracy: 0.9657 - lr: 6.
    4000e-04
115 Epoch 25/50
116 179/179 [==============================] - 171s
    954ms/step - loss: 0.0176 - accuracy: 0.9947 -
```

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116 val_loss: 0.1054 - val_accuracy: 0.9680 - lr: 6.
    4000e-04
117 Epoch 26/50
118 179/179 [==============================] - 138s
    767ms/step - loss: 0.0212 - accuracy: 0.9949 -
    val_loss: 0.0639 - val_accuracy: 0.9832 - lr: 6.
    4000e-04
119 Epoch 27/50
120 179/179 [==============================] - 86s 472ms
    /step - loss: 0.0132 - accuracy: 0.9958 - val_loss:
    0.0781 - val_accuracy: 0.9786 - lr: 5.1200e-04
121 Epoch 28/50
122 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0099 - accuracy: 0.9968 - val_loss:
    0.2340 - val_accuracy: 0.9565 - lr: 5.1200e-04
123 Epoch 29/50
124 179/179 [==============================] - 73s 406ms
    /step - loss: 0.0173 - accuracy: 0.9944 - val_loss:
    0.0540 - val_accuracy: 0.9847 - lr: 5.1200e-04
125 Epoch 30/50
126 179/179 [==============================] - 73s 406ms
    /step - loss: 0.0069 - accuracy: 0.9981 - val_loss:
    0.0537 - val_accuracy: 0.9863 - lr: 5.1200e-04
127 Epoch 31/50
128 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0069 - accuracy: 0.9975 - val_loss:
    0.0815 - val_accuracy: 0.9847 - lr: 4.0960e-04
129 Epoch 32/50
130 179/179 [==============================] - 73s 403ms
    /step - loss: 0.0083 - accuracy: 0.9972 - val_loss:
    0.0677 - val_accuracy: 0.9840 - lr: 4.0960e-04
131 Epoch 33/50
132 179/179 [==============================] - 72s 403ms
    /step - loss: 0.0041 - accuracy: 0.9989 - val_loss:
    0.0562 - val_accuracy: 0.9893 - lr: 4.0960e-04
133 Epoch 34/50
134 179/179 [==============================] - 73s 405ms
    /step - loss: 0.0107 - accuracy: 0.9961 - val_loss:
    0.0933 - val_accuracy: 0.9840 - lr: 4.0960e-04
135 Epoch 35/50
136 179/179 [==============================] - 72s 403ms
```

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136 /step - loss: 0.0079 - accuracy: 0.9974 - val_loss:
    0.0631 - val_accuracy: 0.9886 - lr: 3.2768e-04
137 Epoch 36/50
138 179/179 [==============================] - 73s 404ms
    /step - loss: 0.0038 - accuracy: 0.9979 - val_loss:
    0.0658 - val_accuracy: 0.9870 - lr: 3.2768e-04
139 Epoch 37/50
140 179/179 [==============================] - 72s 403ms
    /step - loss: 0.0020 - accuracy: 0.9993 - val_loss:
    0.0761 - val_accuracy: 0.9878 - lr: 3.2768e-04
141 Epoch 38/50
142 179/179 [==============================] - 73s 404ms
    /step - loss: 0.0055 - accuracy: 0.9979 - val_loss:
    0.0688 - val_accuracy: 0.9870 - lr: 3.2768e-04
143 Epoch 39/50
144 179/179 [==============================] - 74s 411ms
    /step - loss: 0.0027 - accuracy: 0.9989 - val_loss:
    0.0814 - val_accuracy: 0.9840 - lr: 2.6214e-04
145 Epoch 40/50
146 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0039 - accuracy: 0.9988 - val_loss:
    0.0847 - val_accuracy: 0.9817 - lr: 2.6214e-04
147 Epoch 41/50
148 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0040 - accuracy: 0.9981 - val_loss:
    0.0451 - val_accuracy: 0.9893 - lr: 2.6214e-04
149 Epoch 42/50
150 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0015 - accuracy: 0.9991 - val_loss:
    0.0650 - val_accuracy: 0.9901 - lr: 2.6214e-04
151 Epoch 43/50
152 179/179 [==============================] - 72s 402ms
    /step - loss: 0.0023 - accuracy: 0.9991 - val_loss:
    0.0670 - val_accuracy: 0.9870 - lr: 2.6214e-04
153 Epoch 44/50
154 179/179 [==============================] - 72s 401ms
    /step - loss: 0.0019 - accuracy: 0.9991 - val_loss:
    0.0594 - val_accuracy: 0.9886 - lr: 2.6214e-04
155 Epoch 45/50
156 179/179 [==============================] - 72s 400ms
    /step - loss: 0.0036 - accuracy: 0.9984 - val_loss:
```

```
156 0.0466 - val_accuracy: 0.9924 - lr: 2.6214e-04
157 Epoch 46/50
158 179/179 [==============================] - 72s 401ms
    /step - loss: 0.0012 - accuracy: 0.9993 - val_loss:
    0.0543 - val_accuracy: 0.9908 - lr: 2.0972e-04
159 Epoch 47/50
160 179/179 [==============================] - 73s 406ms
    /step - loss: 0.0060 - accuracy: 0.9977 - val_loss:
    0.0512 - val_accuracy: 0.9901 - lr: 2.0972e-04
161 Epoch 48/50
162 179/179 [==============================] - 72s 403ms
    /step - loss: 0.0017 - accuracy: 0.9991 - val_loss:
    0.0570 - val_accuracy: 0.9901 - lr: 2.0972e-04
163 Epoch 49/50
164 179/179 [==============================] - 72s 401ms
    /step - loss: 0.0016 - accuracy: 0.9988 - val_loss:
    0.0877 - val_accuracy: 0.9901 - lr: 2.0972e-04
165 Epoch 50/50
166 179/179 [==============================] - 72s 403ms
    /step - loss: 0.0015 - accuracy: 0.9991 - val_loss:
    0.0783 - val_accuracy: 0.9878 - lr: 1.6777e-04
167 41/41 [==============================] - 4s 99ms/
    step - loss: 0.0466 - accuracy: 0.9924
168 Test accuracy: 99.2372%
169 Class-wise metrics:
170 Class: Glioma
171 Precision: 1.0000
172 Recall: 0.9833
173 F1-Score: 0.9916
174
175 Class: Meninigioma
176 Precision: 0.9837
177 Recall: 0.9869
178 F1-Score: 0.9853
179
180 Class: Notumor
181 Precision: 1.0000
182 Recall: 1.0000
183 F1-Score: 1.0000
184
185 Class: Pituitary
```

```
186 Precision: 0.9836
187 Recall: 0.9967
188 F1-Score: 0.9901
189
190 Overall Accuracy: 0.9924
191
192 Process finished with exit code -805306369 (
    0xCFFFFFFF)
193
```