

**ECE 4370 Project 6 Report**

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# 1. C. Elegans Dataset CNN Classification

Source of libraries used for CNN Implementation	Python 3.10.1, using: <ul style="list-style-type: none"> <li>• PyTorch 1.11.0 with torchvision 0.12.0</li> <li>• OpenCV 4.5.5.64</li> <li>• NumPy 1.22.1</li> </ul>
Complexity of network employed (number of learnable parameters)	<ul style="list-style-type: none"> <li>• First convolutional layer:               <ul style="list-style-type: none"> <li>○ <math>8 \times (5 \times 5 \times 1) + 8 = 208</math></li> </ul> </li> <li>• Second convolutional layer:               <ul style="list-style-type: none"> <li>○ <math>16 \times (5 \times 5 \times 8) + 16 = 3216</math></li> </ul> </li> <li>• Fully-connected network:               <ul style="list-style-type: none"> <li>○ <math>16 \times (8 \times 8) = 1024</math></li> </ul> </li> <li>• Total learnable parameters:               <ul style="list-style-type: none"> <li>○ <math>1024 + 3216 + 208 = 4448</math></li> </ul> </li> </ul>
Training information	<ul style="list-style-type: none"> <li>• 2 Convolution layers consisting of               <ul style="list-style-type: none"> <li>○ 2D Convolution</li> <li>○ ReLU</li> <li>○ Max Pooling</li> </ul> </li> <li>• 1 Linear Layer in fully -connected network</li> </ul> <p>Optimizers:</p> <ul style="list-style-type: none"> <li>• Mini-Batch stochastic gradient descent with momentum               <ol style="list-style-type: none"> <li>1. Batch size = 1000</li> <li>2. Rho = 0.08</li> <li>3. Beta = 0.94</li> </ol> </li> <li>• Cross-entropy loss function</li> </ul>
Training and testing execution times	<ul style="list-style-type: none"> <li>• Training time: 3 minutes, 22 seconds</li> <li>• Testing time: 11.8 seconds</li> </ul>

- Training information (confusion matrix plus accuracy)

n = 8301	Actual K = 0	Actual K = 1
Predicted K = 0	3988	300
Predicted K =1	145	3868
Classification accuracy	94.6 %	--

- Testing information (confusion matrix plus accuracy)

n = 2075	Actual K = 0	Actual K =1
Predicted K = 0	1020	67
Predicted K =1	35	953
Classification accuracy	95.1 %	--