**Purpose**

The purpose of this assignment is to familiarize you with neural networks and their applications. More specifically, you will learn to collect training data for a robotics task and, in turn, design a neural network that can process this data. In the assignment your goal is to help a small robot navigate a simulated environment without any collisions. To accomplish this, you will need to train a neural network using backpropagation that predicts whether the robot is going to collide with any walls or objects in the next time step. All of the theories and best-practices introduced in the class are applicable here. Your task is to make sure the little fellow can safely explore its environment!

**Objectives**

Students will be able to:

* Collect and manage a dataset used to train and test a neural network.
* Define and use PyTorch DataLoaders to manage a PyTorch Datasets.
* Design your own neural network architecture in PyTorch.
* Evaluate and improve a neural network model and verify an application in simulation.

**Technology Requirements**

* System designed for use with Ubuntu 18.04
* Python and its related libraries. Using Anaconda is recommended.
* Python libraries: cython matplotlib sklearn scipy pymunk pygame pillow numpy noise torch

**Project Description**

Note: For the project description, please see the attached "**CSE 571\_Neural Network for Collision Prediction\_Overview Document**" PDF.

**Submission Directions for Project Deliverables**

**Part 1**

Files to submit:

*submission.csv*

**Part 2**

Files to submit:

*Data\_Loaders.py*

**Part 3**

Files to submit:

*submission.zip* – containing:

*> Data\_Loaders.py*

*> Networks.py*

**Part 4**

Files to submit:

*submission.zip* – containing:

> Networks.py

> saved/

>saved\_model.pkl

>scaler.pkl

**Evaluation**

**Part 1**

Pass/Fail 1 point

**Part 2**

Pass/Fail 1 point

**Part 3**

Pass/Fail 1 point

**Part 4**

0-7 points. TBD: 3% of max score will be deducted for every missed collision. 1% of max score will be deducted for every false positive above 10.

**CSE 571\_Project\_Neural Network for Collision Prediction\_Overview Document.pdf**PDF File

[Open file](https://d3c33hcgiwev3.cloudfront.net/3oMmIwJaQq2DJiMCWgKtLA_70dfcafcd117421daf969185d21946f1_CSE-571_Project_Neural-Network-for-Collision-Prediction_Overview-Document.pdf?Expires=1639353600&Signature=Luvx6P8gWfzV8VwEQcozqFchQBI58BTuR47sZep41s-zZlWt0dKjOX4vWEdoGWdiyn0c7nQ80X0nJj3cB71RCxva2OkaYVkR30oWsnJeLHG~xwiVYeoS74i7xEOLSnToXOKxCt5OlKhlI1kGFngSnmlWVKcfRa0iY1-w68cDzO8_&Key-Pair-Id=APKAJLTNE6QMUY6HBC5A" \t "_blank)

**Part1\_Neural Network for Collision Prediction**ZIP File

[Download file](https://d3c33hcgiwev3.cloudfront.net/jNCyL-YgEem5xg6o6fx4wA_e435089901ba4279b386cf8b88bea3a3_Part1_Neural-Network-for-Collision-Prediction.zip?Expires=1639353600&Signature=RH7ID631jQnDt7l3u2CnszpaZIIKJtLlggT1oiMbKMn6ElwgJoYUNAnsYaVPO4SBQFlOQsga5xVX9qw~c3hQVMLpERtk~LW3LH~Wm6zYao9Oy08kWTCdZU7-rW6goe3rYKdLHxgkeZRPvm2WAS7NO6bZLP6TAPjMt4NRDygbgCQ_&Key-Pair-Id=APKAJLTNE6QMUY6HBC5A" \t "_blank)

**Part2\_Neural Network for Collision Prediction**ZIP File

[Download file](https://d3c33hcgiwev3.cloudfront.net/lZkUCeYgEemItBI1qPUVYg_868b4339494d40c08eccd66752e6858c_Part2_Neural-Network-for-Collision-Prediction.zip?Expires=1639353600&Signature=cqTbFgIMcLb~HtMLPKlks-QoDfgMcnQb2RVbU4Itchh1Otxurz8zp~goqmY0qj2Dw7irDm-6qOpRh79KRd2cZ8Pqh4yi5vdrtr0dwW3Jkx5NHqLfNfi9ECJvFDyCK7g089lNSOHxVojLRoGWLNwBFFUTnzkl2icLGup6F1jhNhE_&Key-Pair-Id=APKAJLTNE6QMUY6HBC5A" \t "_blank)

**Part3\_Neural Network for Collision Prediction**ZIP File

[Download file](https://d3c33hcgiwev3.cloudfront.net/ncAszeYgEembNwq8zSOfag_30548665e2664b3199167ed30ddfc694_Part3_Neural-Network-for-Collision-Prediction.zip?Expires=1639353600&Signature=ehKllFO8Sv~gZrlmD3U1hjvBZY0hC-IA8wSO~Ldb7voPgkdkPs38Ra3p6tMv14R5mFtFDAZK4wkVe9jWUiaAieHW~V7JPqwQUrUGEbzg1yWQvCOfEiAMjlwhmLdp0ztniRObyPx50pOgPzXh37oJWsp2F9Q~7SWLD40DZoTH-FQ_&Key-Pair-Id=APKAJLTNE6QMUY6HBC5A" \t "_blank)

**Part4\_Neural Network for Collision Prediction**ZIP File

[Download file](https://d3c33hcgiwev3.cloudfront.net/pm6eWOYgEem5xg6o6fx4wA_a7e3dee567034d3892be9a9229d0c0ae_Part4_Neural-Network-for-Collision-Prediction.zip?Expires=1639353600&Signature=CbvLlSS~Xvn5ctBaoyDv8Qz62C1C9ZD3AXK1qwjTAGdWYPe276r2iMrqfHN~qIHRSMF7zFTQcSzezhEP1y7NpSAfBOzSZ6r7SUknqGk2wPCjNZUoYzNzDIERDCbp6BpBkkx8zIIPOrV2AzAdkjAGNwGdUE7iixh6~MTZuxF0sbQ_&Key-Pair-Id=APKAJLTNE6QMUY6HBC5A" \t "_blank)