DISCERE FACIENDO

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Masters Thesis

Artificial Neural Network-Based Robotics

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3.1 Pad thai 4

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Acknowledgements

I would like to thank everyone for everything.

Abstract

Artificial neural networks (ANNs) are highly-capable alternatives to traditional problem solving schemes due to their ability to solve non-linear systems with a non-algorithmic approach. The applications of ANNs range from process control to pattern recognition and, with increasing importance, robotics. A robot is created with multiple sensors and actuators for environment perception, movement and object manipulation while an on-board microcontroller processes the ANNs and provides the control interface. After training, the neural networks use the various sensor inputs to make the robot accomplish a series of tasks. The system demonstrates how effective and applicable ANNs are to robotic control.

Chapter 1

Introduction

Chapter 2

Project Plan (draft)

2.1 Problem

Create a competition robot for Roborodentia and control it using neural networks.

2.2 Solution

Design and manufacture a robot. Write firmware with a neural network implementation and train it to perform competition tasks.

2.3 Objectives

- Select robot design criteria.
- Create several solutions and prototype a few proof-of-concepts.
- Design electrical systems:
  - Power systems: Batteries, regulation, distribution.
  - Microcontroller: sufficient processing power and IO.
  - Sensors: dependent on control strategy. What information needed?
  - Actuators
- Model robot in SolidWorks with attention to manufacturing.
- Order parts and manufacture robot.
- Bring up electrical system and perform functional checks.
- Design neural network and training plan.
- Develop firmware: neural network, FSM design, communications, debug code.

- Train network and tune.
- Revise mechanical/electrical/firmware and repeat.

2.4 Tasks and Timeline

Chapter 3

LaTeX Usage

3.1 Figures and Ref

This is where I introduce stuff. See Figure 3.1.

Figure 3.1: Pad thai

3.2 Math

$$f(x) = x^2 \tag{3.1}$$

This is an equation that we don't want to number:

$$f(x) = x^2$$

Here's an in-line equation: $f(x) = x^2$.

Here's an aligned equation: Aligns at the &.

$$\begin{aligned} 1 + 2 &= 3 \\ 1 &= 3 - 2 \\ f(x) &= x^2 \\ g(x) &= \frac{1}{x} \\ F(x) &= \int_b^a \frac{1}{3} x^3 \\ \frac{1}{\sqrt{x}} \end{aligned}$$

$$\begin{bmatrix} a & \lambda \\ c & d \end{bmatrix}$$

3.3 Citations

Random citation [1] embeddeed in text.

Random citation [2] embeddeed in text.

Random citation [1] embeddeed in text.

3.4 Accents

Première ẋ

3.5 Dashes

The space is 3-dimensional.

Read pages 3–4.

I saw them—there were 3 men alive

The temperature dropped to −3 degrees.

3.6 Lists

- First Level
    - Second Level
        - Third Level
            - Fourth Level

1. First level item
2. First level item
    (a) Second level item
    (b) Second level item
        i. Third level item
        ii. Third level item
            A. Fourth level item
            B. Fourth level item

3.7 Groups

will produce a paragraph that is four (this is an easy mistake to make).

3.8 Code highlighting

```
class MyClass(Yourclass):
def __init__(self, my, yours):
bla = '5 1 2 3 4'
print bla
```

Chapter 4

Control Problem

Chapter 5

Training Algorithm

Chapter 6

Implementation

Chapter 7

Results

Chapter 8

Conclusion

References

[1] D. H. Nguyen and B. Widrow, "Neural networks for self-learning control systems," *IEEE Control Systems Magazine*, 1990. [Online]. Available: `https://web.stanford.edu/class/ee373b/NNselflearningcontrolsystems.pdf`.

[2] J. Doe, *The Book without Title*. Dummy Publisher, 2100.

Appendices