

# GAUSSIAN PROCESSES/ROBOT ARM DYNAMICS

## INTRODUCTION AND METHODS

**Jacob Lister**

Department of Electrical and Computer Engineering  
Department of Mathematical Sciences  
Purdue University Fort Wayne  
Fort Wayne, IN 46805, USA  
aldrjt01@pfw.edu

### ABSTRACT

abstract

## 1 INTRODUCTION

intro

### 1.1 PROBLEM OVERVIEW

talk about inverse dynamics for robot arms problem statement

### 1.2 KINEMATICS OVERVIEW

robot movement is highly nonlinear (explain kinematics a bit)

## 2 METHODS

In this section, I describe the data source, Gaussian Processes Regression (GPR) which I am considering, Projected Processes (PP) Approximation, and provide a summary of my analysis.

### 2.1 DATA SOURCE AND SOFTWARE

The SARCOS dataset was taken from the website for the textbook *Gaussian Processes for Machine Learning* Rasmussen (2006). The analysis will be performed using the software Python 3.10 and the packages `numpy` and `scipy`. The dataset is publicly available and the code will be publicly available in a Github Repository (Lister).

### 2.2 GUASSIAN PROCESSES REGRESSION (GPR)

gaussian process regression

### 2.3 PROJECTED PROCESSES APPROXIMATION

Use the Project Processes (PP) methods due to combination of high performance and lower time complexity. Has performance very similar to ST and BCM methods

cite table 8.1 for methods section when talking about time comparison for SR and PP methods

## 3 CITATIONS, FIGURES, TABLES, REFERENCES

These instructions apply to everyone, regardless of the formatter being used.

Table 1: Sample table title

PART	DESCRIPTION
Dendrite	Input terminal
Axon	Output terminal
Soma	Cell body (contains cell nucleus)

### 3.1 CITATIONS WITHIN THE TEXT

Citations within the text should be based on the `natbib` package and include the authors' last names and year (with the "et al." construct for more than two authors). When the authors or the publication are included in the sentence, the citation should not be in parenthesis using `\citet{}` (as in "See ? for more information."). Otherwise, the citation should be in parenthesis using `\citep{}` (as in "Deep learning shows promise to make progress towards AI (?).").

The corresponding references are to be listed in alphabetical order of authors, in the REFERENCES section. As to the format of the references themselves, any style is acceptable as long as it is used consistently.

### 3.2 FIGURES

All artwork must be neat, clean, and legible. Lines should be dark enough for purposes of reproduction; art work should not be hand-drawn. The figure number and caption always appear after the figure. Place one line space before the figure caption, and one line space after the figure. The figure caption is lower case (except for first word and proper nouns); figures are numbered consecutively.

Make sure the figure caption does not get separated from the figure. Leave sufficient space to avoid splitting the figure and figure caption.

You may use color figures. However, it is best for the figure captions and the paper body to make sense if the paper is printed either in black/white or in color.

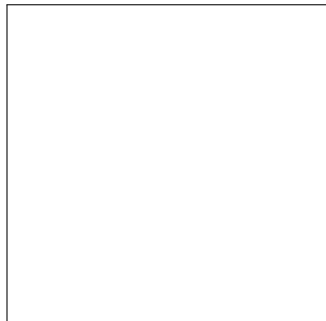


Figure 1: Sample figure caption.

### 3.3 TABLES

All tables must be centered, neat, clean and legible. Do not use hand-drawn tables. The table number and title always appear before the table. See Table 1.

Place one line space before the table title, one line space after the table title, and one line space after the table. The table title must be lower case (except for first word and proper nouns); tables are numbered consecutively.

### 3.4 MARGINS IN L<sup>A</sup>T<sub>E</sub>X

Most of the margin problems come from figures positioned by hand using `\special` or other commands. We suggest using the command `\includegraphics` from the `graphicx` package. Always specify the figure width as a multiple of the line width as in the example below using `.eps` graphics

```
\usepackage[dvips]{graphicx} ...  
\includegraphics[width=0.8\linewidth]{myfile.eps}
```

or

```
\usepackage[pdftex]{graphicx} ...  
\includegraphics[width=0.8\linewidth]{myfile.pdf}
```

for `.pdf` graphics. See section 4.4 in the graphics bundle documentation (<http://www.ctan.org/tex-archive/macros/latex/required/graphics/grfguide.ps>)

A number of width problems arise when L<sup>A</sup>T<sub>E</sub>X cannot properly hyphenate a line. Please give L<sup>A</sup>T<sub>E</sub>X hyphenation hints using the `\-` command.

### REFERENCES

Lister. URL <https://github.com/jacobtlister/stat512-project>.

Williams Rasmussen. Gaussian processes for machine learning - data, 2006. URL <https://gaussianprocess.org/gpml/data/>.