

# COGS 185 — Advanced Machine Learning Methods

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## Preface

These are a collection of notes personally taken by me, specifically for readings and allotted content for UCSD's COGS 185 Advanced Machine Learning Methods taken in Spring 2023. These notes are not endorsed by the lecturers nor staff, and I have modified them (often significantly) over random periods of time. They may become nowhere near accurate representations of what was actually lectured, or written in the books, and are simply to aid in my own understanding. In particular, all errors are almost surely mine.

*Notes are taken real time, and will be reviewed, updated, and revised within 48 hours of each lecture.*

My other notes are available **here**.

## 0 Introduction

Placeholder

## Logistics

Placeholder

# 1 A Review of Supervised Learning

## **2 Multi-Class Classification**





## 3 Support Vector Machines

### 3.1 Pegasos

### 3.2 Cutting Plane Algorithm

## 4 Softmax function

### 4.1 Multi-label classification

## 5 Structured Prediction

### 5.1 Structural SVM

### 5.2 Max-Margin Markov Networks

## 6 Random Fields

### 6.1 Markov Random Fields

### 6.2 Conditional Random Fields

## 7 Auto-Context

### 7.1 Fixed Point Modeling

### 7.2 Graphical Models

### 7.3 A Summary of Structured Prediction

## 8 Auto-Context (Cont.)

### 8.1 Hidden Markov Models

## 9 Recurrent Neural Networks

## 10 Recurrent Neural Networks (Cont.)

## 11 Attention based models

### 11.1 Attention Is All You Need

## 12 Transformers

### 12.1 Graph Neural Networks

## 13 Large Language Models

## 14 Compressive Sensing

### 14.1 Robust Principal Component Analysis