
Project 2

Supervised Classifiers

Homework 1 Grades

→ **The grades are on CANVAS**

Look at the Grade feedback and click the blue button on the right

Homework 1 Due

This is the dropbox for Homework 1.



Assignment Dashboard Summary

Homework 1 Due

Paper Title

Uploaded

Grade

HW1

20 Jan 2018 00:00 EST

95



Grade Feedback button



Blue Button



Administration

- **You do not have to use Latex for your project report.**

The latex template is meant to guide you

- **Make sure to submit a pdf**

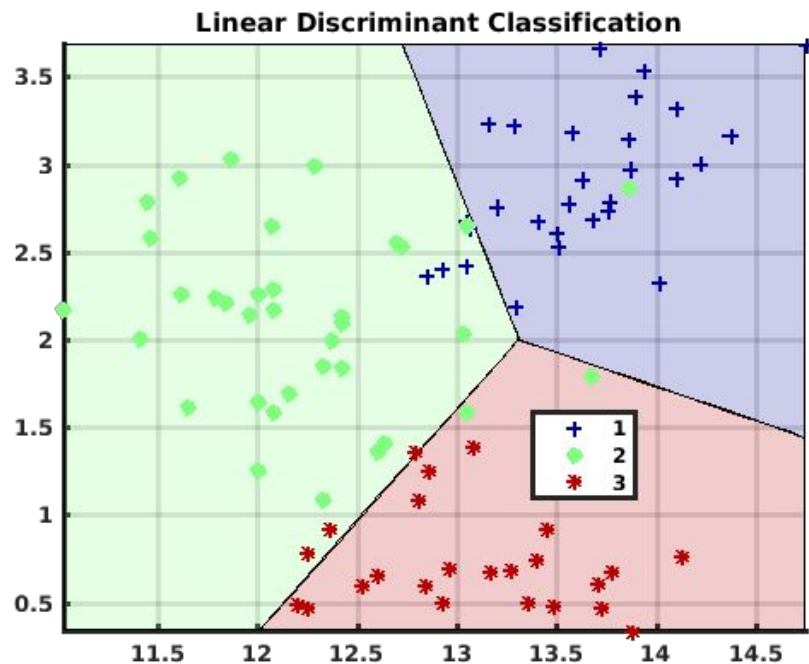
Makes sure to submit a PDF

- **Don't use matlab in-built classifiers**

You have to code these functions yourself

Goals

- Learn about LDA
- Learn about Fisher Projection
 - How to classify in the projected space
- Learn how to compare two classifiers on three different datasets



Wine Dataset

Using chemical analysis to classify three wines (cultivars) from the same region in Italy.

Beat the wine experts who have been proven to not know the difference between wines



Tip

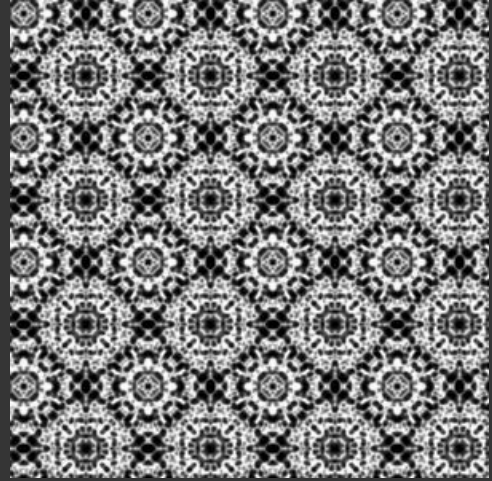
This dataset is smaller and easy to classify using only two features so it is a good one to use initially.

Wallpaper Dataset

Find which of the **17** wallpaper patterns is contained in each image.

There are **1700** images (**100** from each class) in the train and test datasets

Features are a bag of Surf keypoints [1]



[1] Csurka, G., C. R. Dance, L. Fan, J. Willamowski, and C. Bray. Visual Categorization with Bags of Keypoints. Workshop on Statistical Learning in Computer Vision. 2004, ECCV 1 (1-22), 1-2.

Taiji Dataset

Find which of the 7 moves is starting from the MoCAP joint angles (in quaternions).

Dataset contains 35 sequences of 4 individuals performing 24-form Taiji.

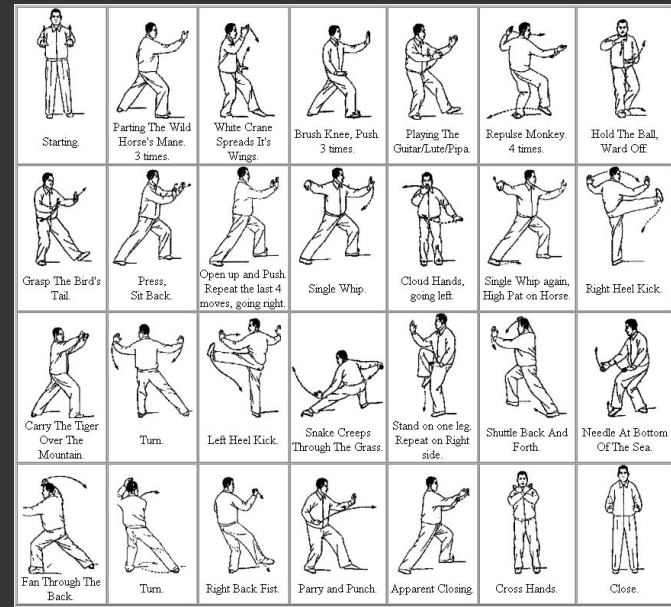
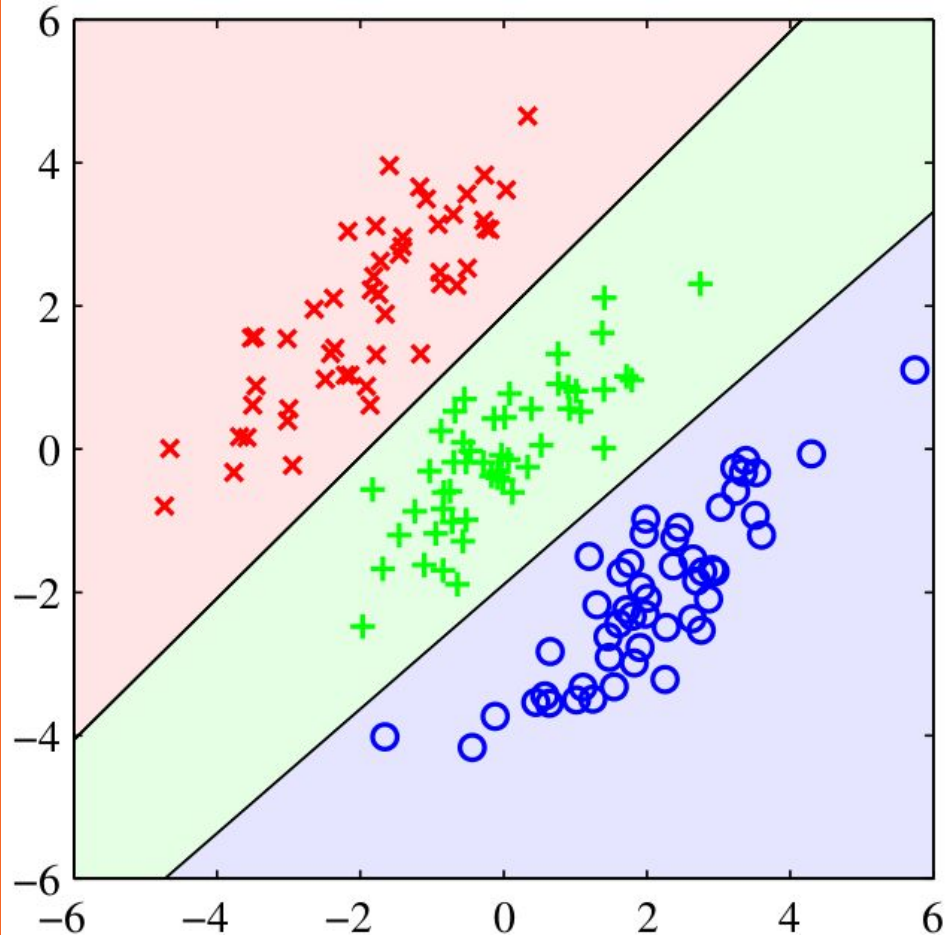


Figure: Taiji Moves

All the Taiji Moves from the 24-Form. We are only use 7 of them.

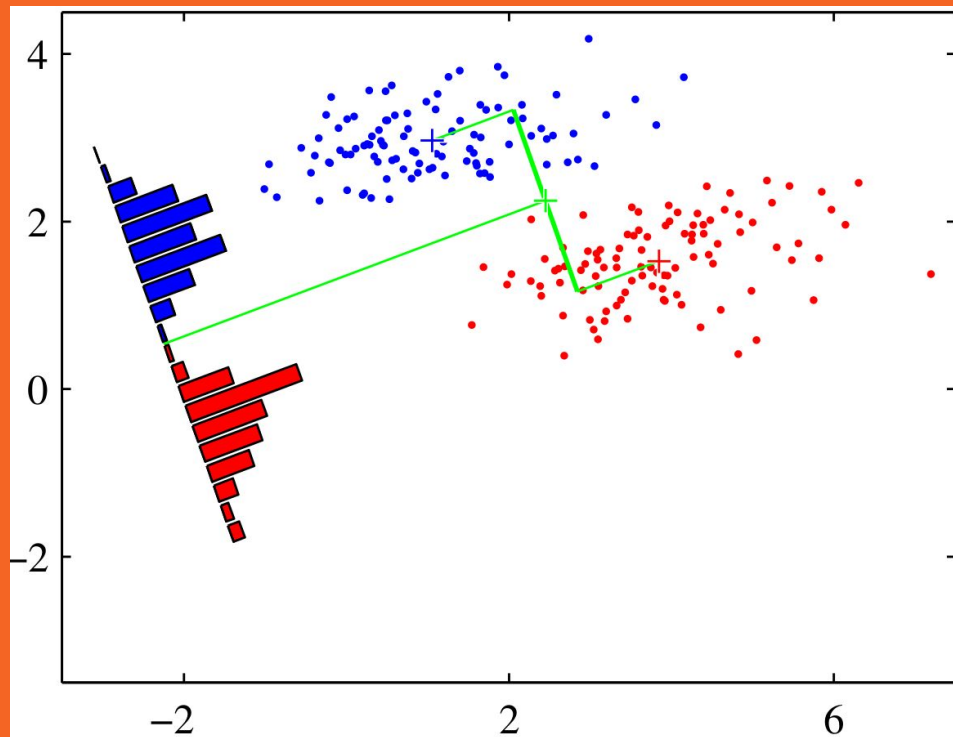
You will need to program a
LDA Classifier



You will need to program a
Fisher Projection

As well as a **Classifier**
in the projected space.
Either:

- KNN (Bishop 2.5.2)
- Decision Theory (end of Bishop 4.1.4)





Each Approach needs

→ **Training Function**

To take the training features and labels and return the trained classifier

→ **Testing Function**

To take the trained classifier and a set of features and return the class labels



Report

→ Explanation and Equations

For both approaches

→ Analysis

Explanation of your results (not just figures)

Confusion/Classification matrix

Any Outliers in the data?

→ Extra Credit

Make sure to add this to the report



Confusion/ Classification Matrix

→ What each group is classified as

True label	P1	11709	185	70	4	12	0	0	0	0	0	19	0	0	1	0	0	0	0	0
	P2	62	11082	21	19	1	91	24	0	1	690	8	0	0	0	0	0	1	0	0
	PM	58	27	11843	6	17	29	20	0	0	0	0	0	0	0	0	0	0	0	0
	PG	3	0	6	11932	8	0	43	1	0	0	0	1	0	0	6	0	0	0	0
	CM	96	19	212	6	11582	10	3	0	64	0	0	0	3	1	0	4	0	0	0
	PMM	2	586	76	0	8	10758	8	0	37	163	354	0	0	0	0	0	8	0	0
	PMG	0	3	15	114	0	0	11866	2	0	0	0	0	0	0	0	0	0	0	0
	PGG	0	0	0	0	0	0	0	11874	0	0	0	125	0	0	1	0	0	0	0
	CMM	2	91	2	5	231	60	11	2	11174	30	354	7	0	0	0	0	16	15	0
	P4	7	920	0	5	0	71	0	1	5	10727	250	0	0	0	0	0	14	0	0
	P4M	0	46	0	0	1	465	0	0	187	475	10793	9	0	0	2	16	6	0	0
	P4G	0	0	0	0	0	0	0	1033	11	0	5	10941	0	0	6	0	4	0	0
	P3	1	0	0	1	2	0	0	0	0	0	0	0	9347	60	275	2314	0	0	0
	P3M1	0	0	0	0	0	8	0	0	0	0	2	0	176	11459	3	145	207	0	0
	P31M	0	0	0	8	17	0	1	34	0	0	1	1	80	24	11515	278	41	0	0
	P6	0	4	3	0	9	16	0	1	1	5	6	0	527	39	138	11158	93	0	0
	P6M	0	0	0	0	0	41	2	0	5	8	29	1	0	168	63	472	11211	0	0
		P1	P2	PM	PG	CM	PMM	PMG	PGG	CMM	P4	P4M	P4G	P3	P3M1	P31M	P6	P6M		
		Predicted label																		

Figure: Confusion Matrix

True Label	P1	97.6%	1.5%	0.6%	0.0%	0.1%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	P2	0.5%	92.3%	0.2%	0.2%	0.0%	0.6%	0.2%	0.0%	0.0%	5.8%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	PM	0.5%	0.2%	98.7%	0.1%	0.1%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	PG	0.0%	0.0%	0.1%	99.4%	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	CM	0.8%	0.2%	1.8%	0.1%	96.5%	0.1%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	PMM	0.0%	4.9%	0.6%	0.0%	0.1%	99.7%	0.1%	0.0%	0.3%	1.4%	3.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	PMG	0.0%	0.0%	0.1%	0.9%	0.0%	0.0%	98.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	PGG	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	99.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CMM	0.0%	0.8%	0.0%	0.0%	1.9%	0.5%	0.1%	0.0%	93.1%	0.2%	3.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
	P4	0.1%	7.7%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	89.4%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	P4M	0.0%	0.4%	0.0%	0.0%	0.0%	3.9%	0.0%	0.0%	1.6%	4.0%	99.9%	0.1%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
	P4G	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.6%	0.1%	0.0%	0.0%	91.2%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	P3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	77.9%	0.3%	2.3%	19.3%	0.0%	0.0%	0.0%	0.0%
	P3M1	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	95.3%	0.0%	1.2%	1.7%	0.0%	0.0%	0.0%
	P31M	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.7%	92.8%	0.0%	2.3%	0.3%	0.0%	0.0%	0.0%
	P6	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	4.4%	0.3%	1.1%	93.0%	0.8%	0.0%	0.0%
	P6M	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.1%	0.2%	0.0%	0.0%	1.4%	0.5%	3.9%	93.4%	0.0%	0.0%	0.0%	0.0%
		P1	P2	PM	PG	CM	PMM	PMG	PGG	CMM	P4	P4M	P4G	P3	P3M1	P31M	P6	P6M			
		Predicted label																			

Figure: Classification Matrix