

# Math 521 Final Project: Cats and Dogs

Due on Tuesday, May 15, 2018

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# Theory

## Introduction

The project we present in this report involves properly classifying two data sets successfully. In this context, the data sets are images of dogs and cats, but the same ideas and algorithms can be successfully applied to other data sets, such as sound waves. Since we are working with images, some preprocessing methods will be explored to add uniformity or variance to the data sets.

## Preprocessing

Image *preprocessing* typically involves filtering or computing the Fourier transform of an image prior to analysis. To this end, we will discuss some basics, beginning with filtering.

Image filtering uses a *mask* matrix on subsets of an image to perform operations. One filter example is the averaging filter: Given an  $m \times n$  mask size, the mask  $m_a$  will be

$$m_a = \frac{1}{mn} \begin{bmatrix} 1 & \cdots & 1 \\ \vdots & \ddots & \vdots \\ 1 & \cdots & 1 \end{bmatrix}$$

where the filtering operation involves an  $m \times n$  neighborhood around each pixel of the original image matrix  $A$ .

## Classification

### Singular Values

The Singular Value Decomposition (SVD) is an important first step in classification.

## Results

### Dogs and Cats

### Classification Types

## Code

## References

- [1] Chang, Jen-Mei. *Matrix Methods for Geometric Data Analysis and Recognition*. 2014.