

# MSDS 621 - Introduction to Machine Learning

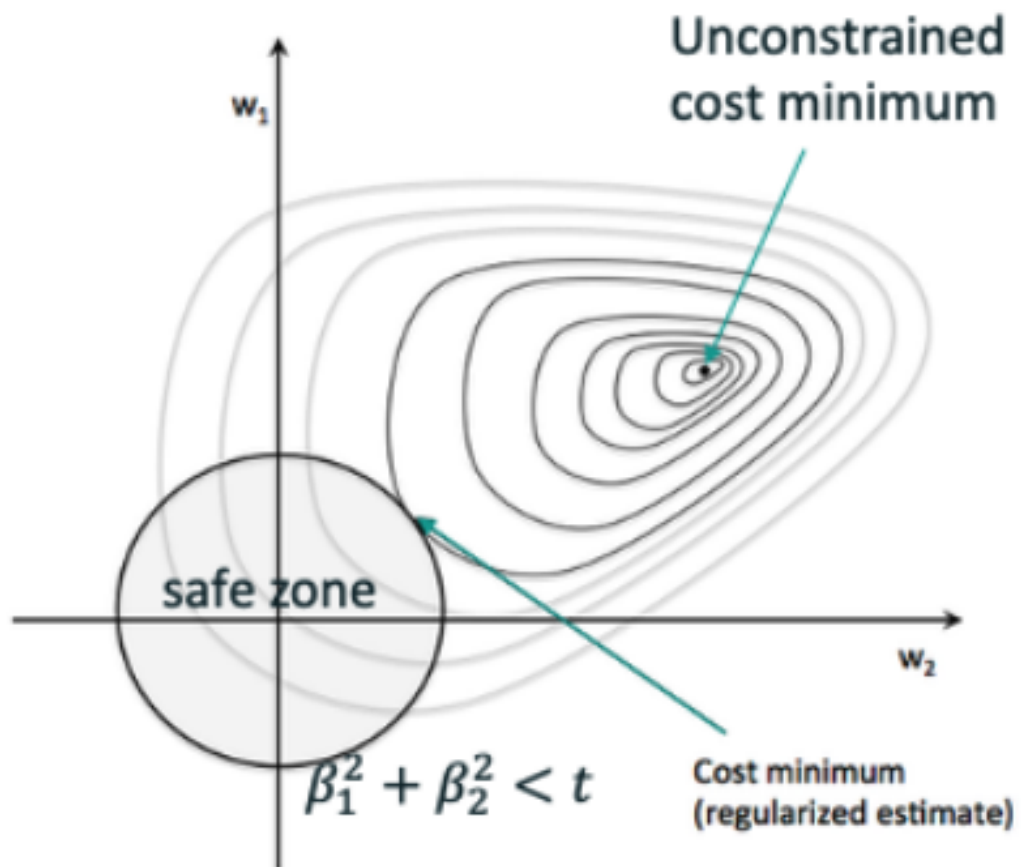
## Exam 1 Review

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Listed below are all of the topics that you need to be familiar with for the exam. The exam is mostly conceptual, with 1 or 2 problems requiring a calculation to be done, 1 or 2 code snippet problems, multiple choice, true/false and short answer questions. Below is a list of topics to be familiar with before the exam. I will have, at some point during lecture, in the lecture notes, on the homework, or in the labs, covered each of the topics that will be on the exam.

## 1 Regularization

- What is the purpose of regularization in machine learning?
- How do we do regularization for linear models?
- Understand the shrinkage penalties and names for L1 and L2 regularization and what makes them different from each other.
- Know the closed-form solutions for  $\beta$  for both ridge and unnormalized linear regression and be able to use them to find  $\beta$  for a very simple matrix  $X$ .
- Know the loss functions for linear and logistic regression with and without regularization.
- Understand the *hard* constraint and the *soft* constraint:
  - Know how to identify  $\beta$  visually within a hard constraint safe zone depending on the level curves of the loss function (see figure below).



## 2 Gradient Descent

- Understand the algorithm for vanilla gradient descent and how it works.
- Understand the algorithm for adding momentum to gradient descent and how it works.
- Understand the Adagrad algorithm and how it works.

## 3 Naive Bayes

- Understand and be able to use Bayes' Theorem for a given set of data.

- Understand how Naive Bayes works and be able to apply it to a given set of data.
- Remember the formulas for Naive Bayes, both Bernoulli and Multinomial (but not Gaussian).
- Understand all of the modifications we make to the Naive Bayes formula and why we make them.

## 4 Decision Trees

- Understand how decision trees partition data.
- Understand each of the loss functions used to find the best split for both regression and classification.
- Understand how to make new predictions for both regression and classification using a decision tree.