



## MODULE1 · INTRODUCTION

SUPERVISED LEARNING

UNSUPERVISED LEARNING

### LINEAR REGRESSION WITH ONE VARIABLE

#### MODEL AND COST FUNCTION

MODEL REPRESENTATION

COST FUNCTION

COST FUNCTION – INTUITION I

COST FUNCTION – INTUITION II

#### PARAMETER LEARNING

GRADIENT DESCENT

GRADIENT DESCENT INTUITION

GRADIENT DESCENT FOR LINEAR REGRESSION

### LINEAR ALGEBRA REVIEW

MATRICES AND VECTORS

ADDITION AND SCALAR MULTIPLICATION

MATRIX VECTOR MULTIPLICATION

MATRIX MATRIX MULTIPLICATION

MATRIX MULTIPLICATION PROPERTIES

INVERSE AND TRANSPOSE

## MODULE2 · LINEAR REGRESSION WITH MULTIPLE VARIABLES

### MULTIVARIATE LINEAR REGRESSION

MULTIPLE FEATURES

GRADIENT DESCENT FOR MULTIPLE VARIABLES

GRADIENT DESCENT IN PRACTICE I – FEATURE SCALING

GRADIENT DESCENT IN PRACTICE II – LEARNING RATE

FEATURES AND POLYNOMIAL REGRESSION

### COMPUTING PARAMETERS ANALYTICALLY

NORMAL EQUATION

NORMAL EQUATION NONINVERTIBILITY

### OCTAVE/MATLAB TUTORIAL

BASIC OPERATIONS

MOVING DATA AROUND/COMPUTING ON DATA

PLOTTING DATA

CONTROL STATEMENTS: FOR, WHILE, IF STATEMENT

VECTORIZATION

## MODULE3 · LOGISTIC REGRESSION

## CLASSIFICATION AND REPRESENTATION

CLASSIFICATION

HYPOTHESIS REPRESENTATION

DECISION BOUNDARY

## LOGISTIC REGRESSION MODEL

COST FUNCTION

SIMPLIFIED COST FUNCTION AND GRADIENT DESCENT

ADVANCED OPTIMIZATION

## MULTICLASS CLASSIFICATION

MULTICLASS CLASSIFICATION: ONE-VS-ALL

## REGULARIZATION

### SOLVING THE PROBLEM OF OVERFITTING

THE PROBLEM OF OVERFITTING

COST FUNCTION

REGULARIZED LINEAR REGRESSION

REGULARIZED LOGISTIC REGRESSION

## MODULE4 · NEURAL NETWORKS: REPRESENTATION

### MOTIVATIONS

NONLINEAR HYPOTHESIS

NEURONS AND THE BRAIN

### NEURAL NETWORKS

MODEL REPRESENTATIONS I

MODEL REPRESENTATIONS II

### APPLICATION

EXAMPLES AND INTUITIONS I

EXAMPLES AND INTUITIONS II

MULTICLASS CLASSIFICATION

## MODULE5 · NEURAL NETWORKS: LEARNING

### COST FUNCTION AND BACKPROPOGATION

COST FUNCTION

BACKPROPAGATION ALGORITHM

BACKPROPOGATION INTUITION

### BACKPROPOGATION IN PRACTICE

IMPLEMENTATION NOTE: UNROLLING PARAMETERS

GRADIENT CHECKING

RANDOM INITIALIZATION

PUTTING IT TOGETHER

### APPLICATION OF NEURAL NETWORKS

AUTONOMOUS DRIVING

## MODULE6 · ADVICE FOR APPLYING MACHINE LEARNING

EVALUATION A LEARNING ALGORITHM

DECIDING WHAT TO TRY NEXT  
EVALUATING A HYPOTHESIS  
MODEL SELECTION AND TRAIN/VALIDATION/TEST SETS

#### BIAS VS VARIANCE

DIAGNOSING BIAS VS VARIANCE  
REGULARIZATION AND BIAS/VARIANCE  
LEARNING CURVES  
DECIDING WHAT TO DO NEXT REVISITED

#### MACHINE LEARNING SYSTEM DESIGN

##### BUILDING A SPAM CLASSIFIER

PRIORITIZING WHAT TO WORK ON  
ERROR ANALYSIS

##### HANDLING SKEWED DATA

ERROR METRICS FOR SKEWED CLASSES  
TRADING OFF PRECISION AND RECALL

##### USING LARGE DATA SETS

DATA FOR MACHINE LEARNING

### MODULE 7 · SUPPORT VECTOR MACHINES

#### LARGE MARGIN CLASSIFICATION

OPTIMIZATION OBJECTIVE  
LARGE MARGIN INTUITION  
MATHEMATICS BEHIND LARGE MARGIN CLASSIFICATION

#### KERNELS

KERNELS I  
KERNELS II

#### SVMS IN PRACTICE

USING AN SVM

### MODULE 8 · UNSUPERVISED LEARNING

#### CLUSTERING

UNSUPERVISED LEARNING: INTRODUCTION  
K-MEANS ALGORITHM  
OPTIMIZATION OBJECTIVE  
RANDOM INITIALIZATION  
CHOOSING THE NUMBER OF CLUSTERS

#### DIMENSIONALITY REDUCTION

##### MOTIVATION

MOTIVATION I: DATA COMPRESSION  
MOTIVATION II: VISUALIZATION

##### PRINCIPAL COMPONENTS ANALYSIS

PRINCIPAL COMPONENTS ANALYSIS PROBLEM FORMULATION  
PRINCIPAL COMPONENTS ANALYSIS ALGORITHM

## APPLYING PCA

RECONSTRUCTION FROM COMPRESSED REPRESENTATION

CHOOSING THE NUMBER OF PRINCIPAL COMPONENTS

ADVICE FOR APPLYING PCA

## MODULE9 · ANOMALY DETECTION

### DENSITY ESTIMATION

PROBLEM MOTIVATION

GAUSSIAN DISTRIBUTION

ALGORITHM

### BUILDING AN ANOMALY DETECTION SYSTEM

DEVELOPING AND EVALUATION AN ANOMALY DETECTION SYSTEM

ANOMALY DETECTION VS SUPERVISED LEARNING

CHOOSING WHAT FEATURES TO USE

### MULTIVARIATE GAUSSIAN DISTRIBUTION

MULTIVARIATE GAUSSIAN DISTRIBUTION

ANOMALY DETECTION USING THE MULTIVARIATE GAUSSIAN DISTRIBUTION

## RECOMMENDER SYSTEMS

### PREDICTING MOVIE RATINGS

PROBLEM FORMULATION

CONTENT BASED RECOMMENDATIONS

### COLLABORATIVE FILTERING

COLLABORATIVE FILTERING

COLLABORATIVE FILTERING ALGORITHM

### LOW RANK MATRIX FACTORIZATION

VECTORIZATION: LOW RANK MATRIX FACTORIZATION

IMPLEMENTATION DETAIL: MEAN NORMALIZATION

## MODULE10 · LARGE SCALE MACHINE LEARNING

### GRADIENT DESCENT WITH LARGE DATASETS

LEARNING WITH LARGE DATASETS

STOCHASTIC GRADIENT DESCENT

MINI-BATCH GRADIENT DESCENT

STOCHASTIC GRADIENT DESCENT CONVERGENCE

### ADVANCED TOPICS

ONLINE LEARNING

MAP REDUCE AND DATA PARALLELISM

## MODULE11 · APPLICATION EXAMPLE: PHOTO OCR

### PHOTO OCR

PROBLEM DESCRIPTION AND PIPELINE

SLIDING WINDOWS

GETTING LOTS OF DATA AND ARTIFICIAL DATA

CEILING ANALYSIS: WHAT PART OF THE PIPELINE TO WORK ON NEXT