Introduction

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Discussion

- Significance, Impact and Future of AI.
- What, Why and How in AI.
- Components of AI.
- Learning.

AI Evolution

Future of AI

Applications of AI

Growth of AI

Impact of AI

Challenges of AI

Definition of AI

AI Creativity

Threats of AI

AGI

Human Vs AI

Privacy in AI

AI in Management

AI in Governance

AI in Energy

AI in Space

AI in Health

AI in Banking

AI in Finance

AI in Defense

AI in Agriculture

AI in Media

AI in Education

AI in Oceanography

AI Evolution

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Course Outline

S. No.	Unit Title	Topics	Lectures
1	Introduction to ML	Introduction and Significance of Machine Learning, Supervised, Semi-supervised and Unsupervised learning, Introduction to Classification, Regression and Clustering problems.	2
2	Mathematical and Statistical Foundation	Quick revision of linear algebra for machine learning, Convex functions, Gradient, Steepest descent direction, Gradient Descent method, Stochastic Gradient Descent method, Sub gradients.	6
		Multivariate Analysis , Covariance matrix, Multivariate normal distribution and its properties,.	
3	Model Selection and Evaluation	Evaluation metric for regression and classification models, Training and Testing set, Resampling method, Cross Validation, K-fold cross validation, Leave-one Out method.	2
4	Regression Analysis	Least Squares methods, Least Squares multiple linear regression model, Non-linear multiple regression models through basis functions, Polynomial, Gaussian and Sigmoidal basis, Overfitting, Least Squares kernel regression model, Derivation of least square loss for normal noise using MLE, Need of Regularization, Bias-variance trade-off, Lasso Regression, L_1-norm loss regression model,	11
4.	Classification	Bayesian Classification, Gaussian Models, Naïve Bayes Classifier, Logistic Regression, Soft-max Regression, Neural Network and multilayer perceptron and Support Vector Machine.	14
6.	Unsupervised ML	Feature Selection methods, Dimensionality Reduction: PCA, Basic of clustering, K-mean clustering.	5

Reference Text Books

- Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong. *Mathematics for machine learning*. Cambridge University Press, 2020.
- Bishop, Christopher M. *Pattern recognition and Machine learning* 128.9 (2008).
- Murphy, K. P. (2013). *Machine learning: a probabilistic perspective*. Cambridge, Mass: MIT Press. ISBN: 9780262018029 026201802.
- Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. *The elements of statistical learning*. Vol. 1. No. 10. New York: Springer series in statistics, 2001.
- Duda, Richard O., and Peter E. Hart. *Pattern classification*. John Wiley & Sons, 2006.
- Zaki, Mohammed J., and Wagner Meira Jr. *Data Mining and Machine Learning: Fundamental Concepts and Algorithms*. Cambridge University Press, 2020.
- Deng, Naiyang, Yingjie Tian, and Chunhua Zhang. *Support vector machines: optimization based theory, algorithms, and extensions*. CRC press, 2012.

Evaluation

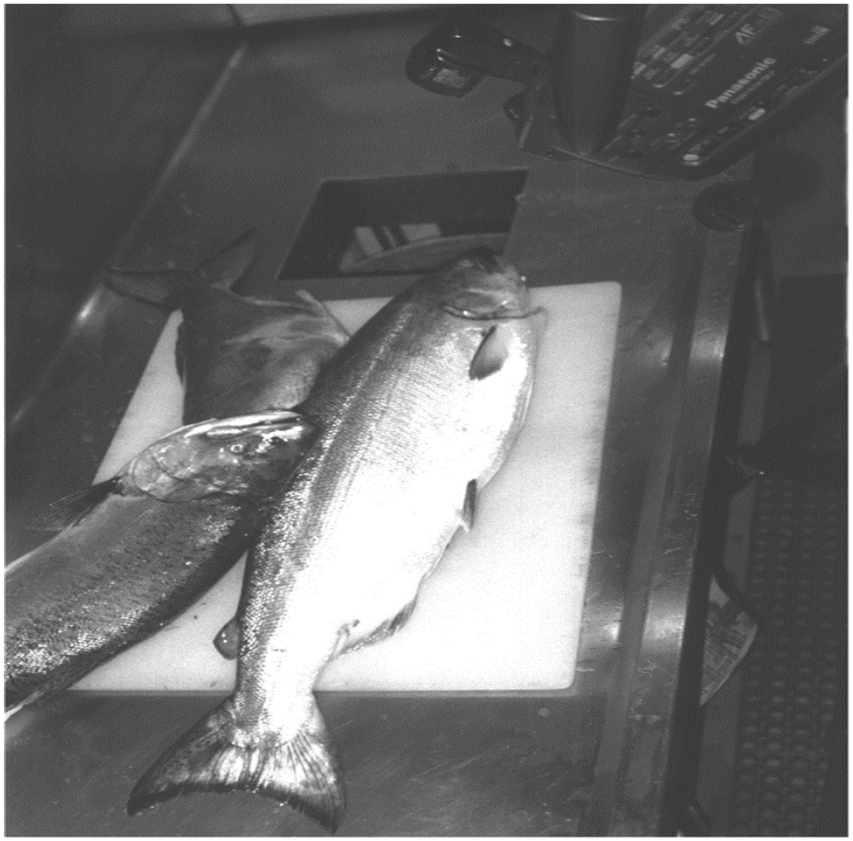
- Surprise Quizzes. (40 Marks) .
- Assignment + Viva+ Lab Test :- (40 Marks).
- End term (20 Marks)

Strict Plagiarism Policy :-

In case the plagiarism is found, the student will not qualify the course and sent to the Plagiarism Disciplinary Committee for penalty.

AI Model

Classification Problem



Length (cm)	Height (cm)	Number of fins	Weight (Kg)	Color	Fish type
17.8	22.9	8	5.1`	Orange	Salman
14.8	20.5	7	4.9	Black	Sea bass
16. 34	12.76	6	6.6	Grey	Salman
10. 34	8.76	3	3.8	Grey	Salman
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11 .30	17.76	6	9.8	Orange	Sea bass

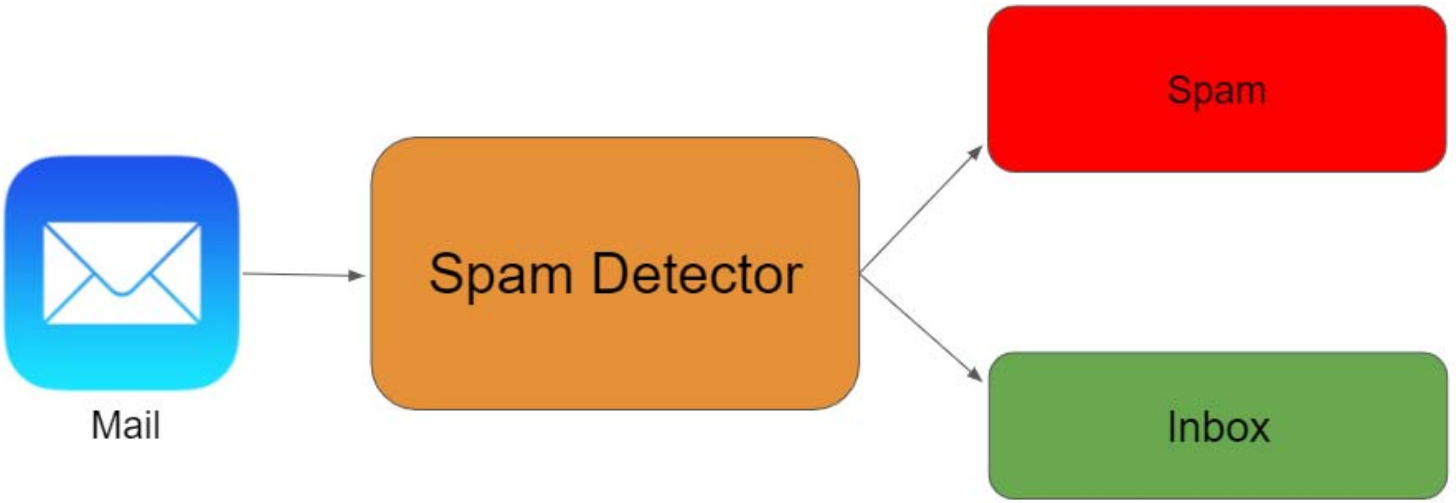
Classification Problem

Length (cm)	Height (cm)	Number of fins	Weight (Kg)	Color	Fish type
17.8	22.9	8	5.1`	1	1
14.8	20.5	7	4.9	2	-1
16. 34	12.76	6	6.6	3	1
10. 34	8.76	3	3.8	3	1
---	-----	----	------	------	--------
11 .30	17.76	6	9.8	1	-1

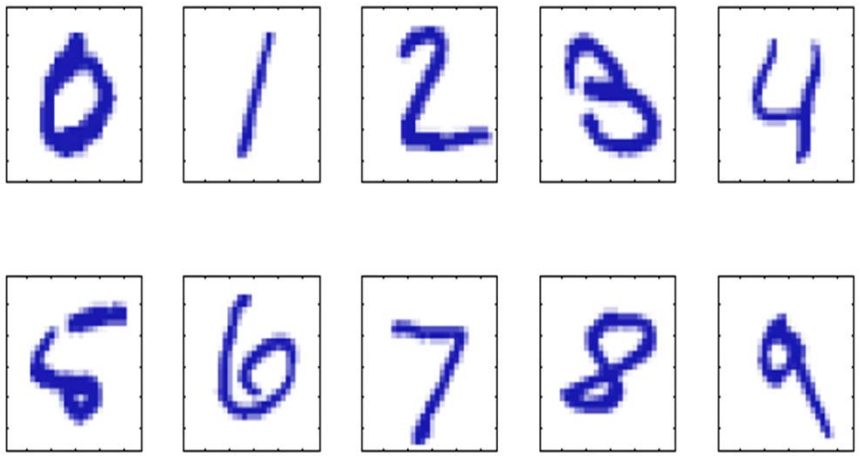
Binary Classification :-

Given a training set $\{ (X_i , Y_i) : X_i \in R^n , Y_i \in \{-1,1\} , i = 1,2,.., l \}$, find a function f which can efficiently predict the label Y for an unseen $X \in R^n$.

Spam Filtering



Hand-digit Recognition



More Examples ??

Salary Prediction

Gender	Education	Seniority	Age	Work class	Income
Male	3	3	34	Private	78 K
Female	2	2	65	Govt.	89 K
Male	1	4	25	Govt.	28 K
Female	5	6	39	Private	112 K
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Female	2	8	45	Govt.	84 K
Female	4	9	40	Private	76 K
Male	2	0	42	Govt.	81 K

Salary Prediction

Gender	Education	Seniority	Age	Work class	Income
0	3	3	34	1	78 K
1	2	2	65	0	89 K
0	1	4	25	0.	28 K
1	5	6	39	1	112 K
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0	2	8	45	0	84 K
1	4	9	40	1	76 K
0	2	0	42	0	81 K

Regression Problem

Gender	Education	Seniority	Age	Work class	Income
0	3	3	34	1	78 K
1	2	2	65	0	89 K
0	1	4	25	0.	28 K
1	5	6	39	1	112 K
---	-----	---	------	------	--------
0	2	8	45	0	84 K
1	4	9	40	1	76 K
0	2	0	42	0	81 K

Given a training set $\{ (X_i , Y_i) : X_i \in R^n , Y_i \in R, i = 1,2,.., l \}$, find a function f which can efficiently approximate the relationship between independent variable X and Y for the prediction of response for an unseen test point $X_{test} \in R^n$.