

# Support Vector Machine (SVM)

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Complete Overview, Analysis  
& Implementation

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# Introduction to Machine Learning

Machine Learning is a subset of Artificial Intelligence.

It allows systems to learn from data and improve automatically.

Supervised Learning uses labeled data for training.

Support Vector Machine is a powerful supervised learning algorithm.

# What is Support Vector Machine (SVM)?

SVM is a supervised learning algorithm.

Used for Classification and Regression tasks.

It finds the optimal hyperplane that separates data.

Works effectively in high-dimensional spaces.

# Why Do We Use SVM?



EFFECTIVE IN HIGH  
DIMENSIONAL DATA.



WORKS WELL WHEN  
NUMBER OF  
FEATURES > SAMPLES.



MEMORY EFFICIENT  
(USES SUPPORT  
VECTORS).



ROBUST AGAINST  
OVERFITTING.

# Core Concepts of SVM



Hyperplane:  
Decision boundary  
separating classes.



Margin: Distance  
between hyperplane  
and nearest points.



Support Vectors:  
Data points closest  
to hyperplane.

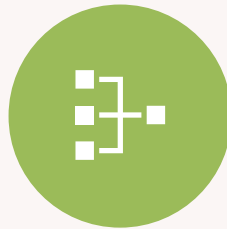


Kernel Trick: Used  
for non-linear  
classification.

# Types of Kernels in SVM



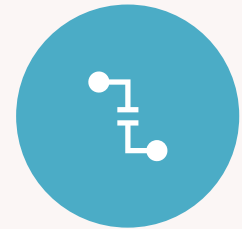
LINEAR KERNEL –  
USED FOR LINEARLY  
SEPARABLE DATA.



POLYNOMIAL KERNEL  
– HANDLES CURVED  
BOUNDARIES.



RBK (RADIAL BASIS  
FUNCTION) – MOST  
COMMONLY USED.



SIGMOID KERNEL –  
SIMILAR TO NEURAL  
NETWORKS.

# Problem Statement

To classify data  
into categories  
accurately.

Identify optimal  
decision  
boundary.

Improve  
prediction  
accuracy.

Reduce  
misclassification  
errors.

## SVM Implementation Steps

1. Data Collection

2. Data Preprocessing (Scaling)

3. Train-Test Split

4. Model Training using SVC

5. Model Evaluation (Accuracy,  
Confusion Matrix)



# Analysis & Outcomes


Training Accuracy and Testing Accuracy compared.





Kernel comparison analysis performed.



Best kernel selected based on performance.



Model shows strong generalization ability.



# Advantages & Limitations

## Advantages:

- High accuracy
- Effective in high dimensions

## Limitations:

- Computationally expensive
- Hard to tune parameters

## Conclusion

SVM is a powerful supervised learning algorithm.

Works well for classification problems.

Kernel trick makes it flexible.

Provides strong performance with proper tuning.

# Acknowledgement



THANKS TO MY MENTORS  
AND LEARNING RESOURCES.



SPECIAL THANKS TO OPEN-  
SOURCE LIBRARIES LIKE  
SCIKIT-LEARN.



PROJECT COMPLETED AS  
PART OF MACHINE LEARNING  
LEARNING JOURNEY.