# Sri Sivasubramaniya Nadar College of Engineering, Chennai

(An autonomous institution affiliated to Anna University)

**Subject Code & Name:** ICS1512 – Machine Learning Algorithms Laboratory
**Academic Year:** 2025–2026 (Odd)
**Batch:** 2023–2028
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# Experiment 1: Working with Python Packages – Numpy, Scipy, Scikit-Learn, Matplotlib

## Aim

To familiarize with essential Python libraries and explore their functionalities for tasks such as array operations, data preprocessing, numerical computing, machine learning workflows, and data visualization.

## Libraries Used

- NumPy
- Pandas
- Matplotlib
- Scikit-Learn
- Seaborn

# Mathematical / Theoretical Overview

This experiment focuses on key preprocessing and analytical steps required for efficient machine learning. The major components include:

1. **Handling Missing Values:** Missing data can bias models or cause failures during training. Columns with missing values were either discarded (if non-essential) or imputed using the mode for categorical attributes to maintain label integrity.

2. **Feature Importance via Word Frequency:** In spam email classification, emails were represented as bag-of-words vectors. Feature relevance was assessed by comparing word frequency across spam and non-spam classes. Rare words were filtered out to retain significant features.

3. **Correlation Analysis:** For numeric datasets (e.g., diabetes, iris), Pearson correlation coefficients were computed between input features and the target variable. Label encoding was applied to categorical targets.

4. **Feature Standardization:** Features often differ in scale. To normalize, Z-score standardization was applied:
$$z = \frac{x - \mu}{\sigma}$$
ensuring zero mean and unit variance.

5. **Label Encoding:** For categorical outputs, classes were converted to integers using LabelEncoder, making them compatible with algorithms requiring numeric inputs.

# Dataset and Suitable Algorithms

| Dataset | ML Task | Algorithms |
|---|---|---|
| Iris Dataset | Multi-class Classification | KNN, SVM |
| Loan Amount Prediction | Regression | Linear Regression |
| Predicting Diabetes | Binary Classification | SVM, XGBoost |
| Email Spam Detection | Binary Classification | Logistic Regression, SVM |
| Handwritten Digit Recognition | Multi-class Classification | CNN, SVM |

# Results and Discussions

- **Iris Dataset:** Classified flowers into three species using sepal and petal dimensions. KNN and SVM were suitable choices.

- **Loan Amount Prediction:** Treated as a regression task using Linear Regression.

- **Diabetes Prediction:** Binary classification using SVM for structured numeric data.

- **Email Spam Detection:** Used word frequency features, classified with Logistic Regression and SVM.

- **Digit Recognition:** Implemented CNN for image classification; SVM works well with extracted features.

# Learning Outcomes

- Applied data cleaning techniques for missing values.

- Performed text analysis using Bag-of-Words for spam detection.

- Conducted feature relevance checks via correlation analysis.

- Standardized numerical features for improved model performance.