# AI Driven Crop Recommendation and Decision Support System


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Under the guidance of
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# Outline

# Introduction

- Agriculture: Backbone of economy and vital for food security
- **Current Challenges:**
  - Unpredictable weather conditions
  - Decreasing soil fertility
  - Water scarcity
  - Overuse of chemical fertilizers
  - Economic losses for farmers
- **Project Focus:**
  - Real-world data analysis
  - Integration of ML models with agricultural data
  - Risk management capabilities
  - Timely decision support
  - Bridging the Gap

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# Problem Statement

- **Major Problems:**
  - Heavy reliance on traditional practices
  - Limited soil and crop-specific knowledge
  - Inadequate for modern challenges
  - Need for precision agriculture
  - Poor crop choices leading to resource inefficiency
- **Infrastructure Limitations:**
  - Lack of timely guidance
  - Limited personalized support
  - Inadequate risk management strategies

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# Literature Review (2018-2021)

**2018: Crop Recommendation System Using ML**

- Algorithms: Decision Trees, SVM, Naive Bayes
- Focus on soil characteristics and weather conditions
- Region-specific agricultural challenges addressed
- Regional tuning needs

**2021: Advanced ML Algorithms Study**

- Multiple classifier comparison
- Integration of environmental factors
- Emphasis on performance metrics
- IoT sensor integration challenges

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# Literature Review (2023-2024)

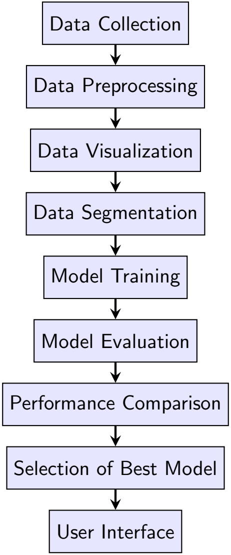
**2023: Data-Driven Analysis**

- Combined crop and fertilizer recommendation
- 97% accuracy achievement
- Focus majorly on soil content levels
- Regional scalability challenges

**2024: Recent Developments**

- Agriculture 5.0 integration
- Sensor data implementation
- Emphasis on precision agriculture
- Deep learning applications

# Methodology Workflow



# Model Training - Part 1

1. **Logistic Regression**
    - C=1.0
    - solver='lbfgs'
    - max_iter=500
2. **Decision Tree**
    - max_depth=10
    - min_samples_split=5
    - min_samples_leaf=4
3. **Random Forest**
    - n_estimators=300
    - max_depth=10
    - class_weight='balanced'

# Model Training - Part 2

4. **Support Vector Machine (SVM)**
   - C=1.2
   - kernel='rbf'
   - gamma='scale'
5. **Gaussian Naive Bayes**
   - var_smoothing=1e-12
6. **Multilayer Perceptron**
   - hidden_layer_sizes=(100, 50)
   - activation='relu'
   - learning_rate_init=0.001

# Model Training - Part 3

## 7. K-Nearest Neighbors

- n_neighbors=10
- weights='uniform'
- metric='minkowski'

## 8. Bagging Classifier

- n_estimators=150
- max_samples=0.6
- max_features=0.6

## 9. Gradient Boosting

- n_estimators=250
- learning_rate=0.01
- subsample=0.8

# Model Performance Comparison

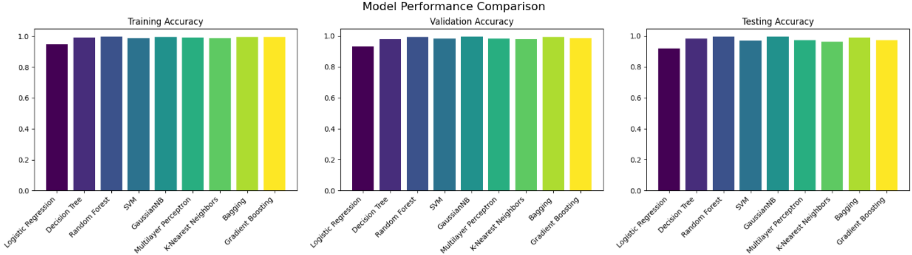



Figure: Training, Validation, and Testing Accuracies Comparison

# Evaluation Metrics

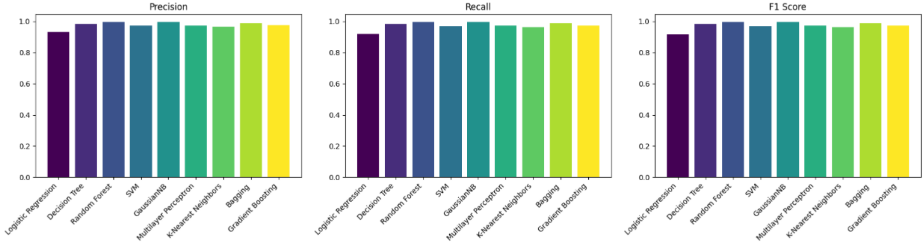



Figure: Precision, Recall, and F1 Score Comparison

# Model Analysis

**Performance Analysis:**

- **Random Forest:**
  - Highest overall performance
  - Excellent generalization
  - Robust across metrics
- **Gradient Boosting:**
  - Strong alternative
  - Consistent performance
- **Gaussian Naive Bayes:**
  - Surprisingly strong results
  - Good feature handling

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# User Interface Design

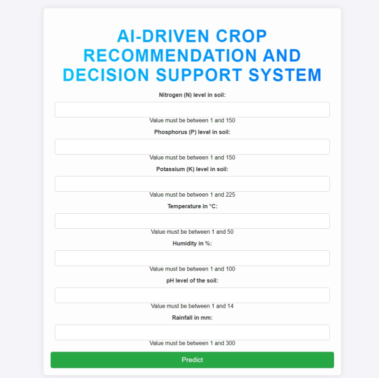


Figure: AI-Driven Crop Recommendation System Interface

- Multi-language support
- Weather Stress Index integration
- User-friendly design

# Conclusion

**Key Achievements:**

- Successful AI integration in agriculture
- Data-driven recommendation system
- Enhanced decision support capabilities
- User-friendly implementation

**Impact:**

- Improved farming practices
- Enhanced crop yield potential
- Better resource utilization
- Sustainable agriculture promotion

# Future Work

**Planned Enhancements:**

- Dataset Expansion:
  - Integration of localized information
  - Real-time satellite data
  - Enhanced weather monitoring
- System Improvements:
  - Extended multilingual support
  - Enhanced UI features
  - Mobile application development
- Continuous Development:
  - Regular feedback integration
  - Model optimization
  - Feature enhancement

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- "Crop Recommendation System using Machine Learning Algorithms," 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), 2021.

- "Data-Driven Analysis and Machine Learning-Based Crop and Fertilizer Recommendation System," Agriculture, 2023.

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"Intelligent Crop Recommendation System for Agriculture 5.0," 2024 International Conference on Communication, Computing and Internet of Things (IC3IoT), 2024.

"AI-Based Agriculture Application for Crop Recommendation and Guidance System for Farmers," 2024 International Conference on Computational Intelligence and Knowledge Economy (ICCIKE), 2024.

# Thank You

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