

# **Employee Performance Prediction using Machine Learning**

**Internship Project under Smart Internz**

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A machine learning-powered Flask web application to predict employee performance in a garment production setting based on various work-related and behavioral metrics.

## Project Overview

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The **Employee Performance Prediction** system uses supervised machine learning algorithms to predict productivity scores for employees based on input parameters like team size, idle time, overtime, and more. This project aims to provide insights that assist in:

- **Talent Retention**
- **Performance Enhancement**
- **Resource Allocation**

The system empowers HR teams and managers to make proactive decisions backed by data.

## Project Objectives

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By completing this project, you will:

- Understand core machine learning concepts and data pipelines.
- Gain experience with data pre-processing and feature engineering.
- Learn to train, evaluate, and deploy ML models.
- Build and integrate a Flask-based UI for real-time predictions.

## Tech Stack

Area	Technologies Used
Language	Python
ML Libraries	Scikit-learn, XGBoost
Visualization	Matplotlib, Seaborn
Web Framework	Flask
Frontend	HTML, CSS

## Use Cases

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### Scenario 1: Talent Retention

Identify high-performing employees at risk of attrition and act proactively.

### Scenario 2: Performance Improvement

Detect employees needing training/support based on prediction trends.

### Scenario 3: Resource Allocation

Assign projects based on predicted productivity to optimize workforce deployment.

## Features

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- Form-based UI for data input
- ML model integration for real-time prediction
- Intuitive, responsive frontend using HTML/CSS
- Supports multiple algorithms (e.g., Random Forest, XGBoost)

## Setup Instructions

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## Prerequisites

- Python 3.8+
- pip
- Virtual environment (optional but recommended)

### Installation

# Clone the repository

```
git clone https://github.com/your-username/employee-performance-predictor.git  
cd employee-performance-predictor
```

# (Optional) Create virtual environment

```
python -m venv venv
```

```
source venv/bin/activate    # Linux/macOS
```

```
venv\Scripts\activate      # Windows
```

# Install required packages

```
pip install -r requirements.txt
```

# Run the app

```
python app.py
```

### Input Parameters

Feature	Description
quarter	Fiscal quarter (Quarter1, Quarter2, etc.)
department	Department of work (e.g., sewing, finishing)
day	Day of the week (e.g., Monday, Tuesday, etc.)
team	Team number assigned to the task
targeted_productivity	Target productivity score for the task
smv	Standard Minute Value – estimated time for the task
over_time	Overtime work in minutes
incentive	Incentive awarded for the task
idle_time	Minutes the team was idle
idle_men	Number of workers idle during the task
no_of_style_change	Number of style changes during task execution
no_of_workers	Number of workers on the task

month

Month in which the task was performed

## ML Model Training Pipeline

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### 1. Data Loading

- Load the dataset using pandas.
- Inspect and clean the data.

### 2. Data Preprocessing

- Handle missing/null values.
- Encode categorical features (quarter, department, day).
- Normalize or scale numerical features as needed.

### 3. Feature Engineering

- Extract relevant features.
- Drop irrelevant columns.

### 4. Train-Test Split

- Split the dataset using `train_test_split()` from Scikit-learn.

### 5. Model Training

- Train models like RandomForest, XGBoost, and DecisionTree.
- Tune hyperparameters for best performance.

### 6. Model Evaluation

- Evaluate models using metrics like:
  - Mean Absolute Error (MAE)
  - Root Mean Square Error (RMSE)
  - R<sup>2</sup> Score

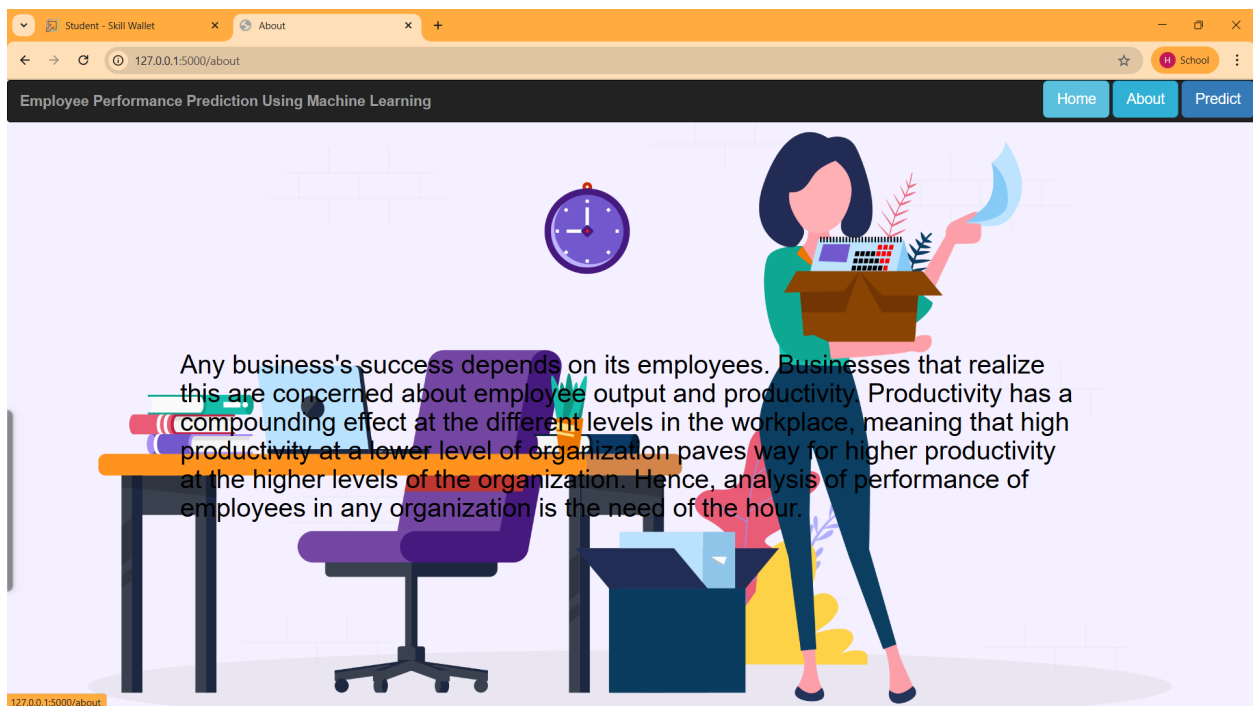
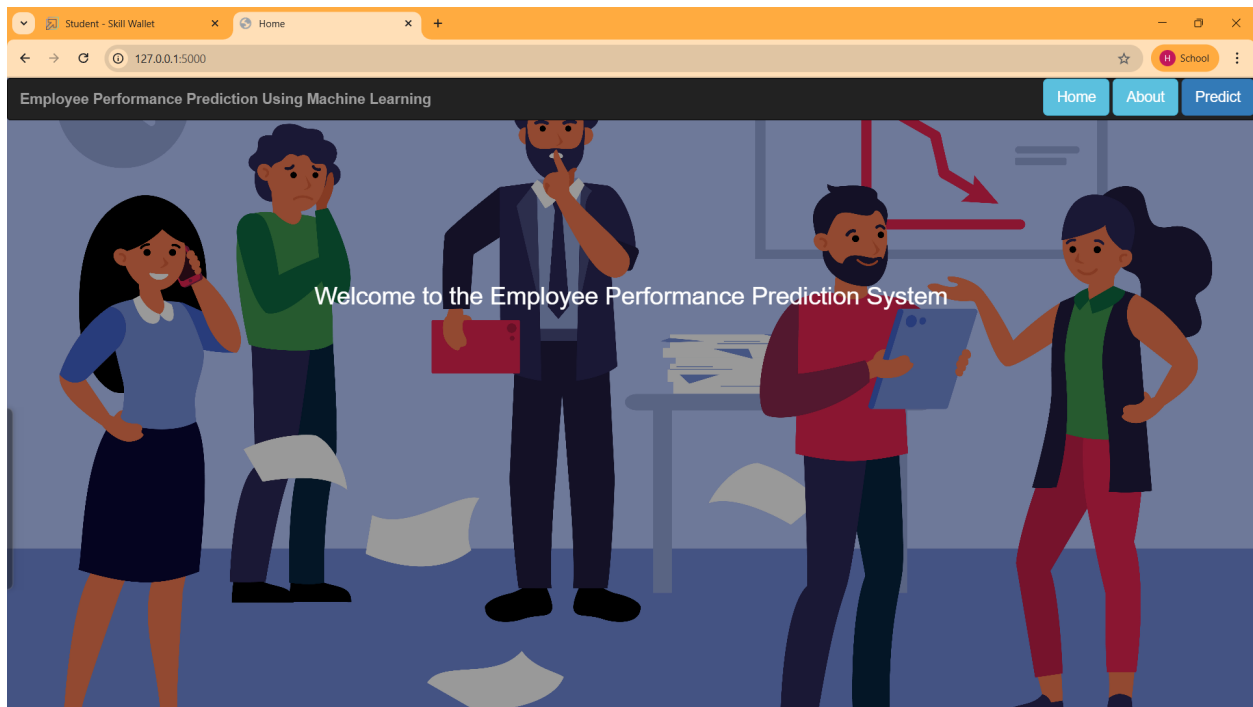
### 7. Model Saving

- Save the best-performing model using pickle or joblib.

### 8. Integration

- Integrate the trained model with the Flask app for predictions.

## Project Outputs



Employee Performance Prediction Using Machine Learning

Home About Predict

Quarter	Department
<input type="text" value="3"/>	<input type="text" value="2"/>
Day	Team
<input type="text" value="3"/>	<input type="text" value="3"/>
Targeted Productivity	SMV
<input type="text" value="0.8"/>	<input type="text" value="10"/>
Over Time	Incentive
<input type="text" value="1000"/>	<input type="text" value="85"/>
Idle Time	Idle Men
<input type="text" value="0"/>	<input type="text" value="0"/>
No. of Style Change	No. of Workers
<input type="text" value="0"/>	<input type="text" value="12"/>
Month	
<input type="text" value="3"/>	

Employee Performance Prediction Using Machine Learning

Home About Predict

Based on the given input, **The employee is Highly productive.**

GitHub Repository Link:- <https://github.com/Hrishabh21/Employee-Performance-Prediction-SmartBridge>

Demo Video Link:- <https://drive.google.com/file/d/1TZf2Y-wD3el2We2wx2S9XswiG41Oxgrv/view?usp=sharing>

## Learning Resources

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- [Google Machine Learning Crash Course](#)
- [IBM SmartBridge AI Training Course](#)
- [Supervised Learning\\_\(Javatpoint\)](#)
- [Unsupervised Learning\\_\(Javatpoint\)](#)
- [Decision Trees](#)
- [Random Forests](#)
- [K-Nearest Neighbors \(KNN\)](#)
- [XGBoost Math & Intuition](#)
- [Model Evaluation Metrics](#)
- [Flask Basics YouTube Tutorial](#)

## Special Thanks

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A special thanks to:

- [SkillWallet by SmartInternz](#)

For offering curated project-based learning opportunities and certifications in emerging tech fields.