



AI for Safer School Zones

Leveraging AI to predict and prevent road accidents near schools, ensuring child safety.

The Vulnerability of School Zones

Children face significant risks from road accidents in school vicinities. Factors like high traffic during peak hours, reckless driving, and insufficient road infrastructure contribute to these dangers. AI offers a powerful solution by analyzing diverse data points to predict accident risks and propose preventative measures, ultimately enhancing child safety.



Traffic Density

Increased vehicle volume during drop-off and pick-up times.



Unsafe Driving

Speeding and distracted driving in residential areas.



Inadequate Signage

Lack of clear warnings or pedestrian crossing indicators.

Problem Statement: An AI-Driven Solution

Our objective is to develop an AI-based predictive system that can proactively identify and mitigate accident risks around schools. This system will analyze complex patterns and recommend actionable safety interventions.



By integrating various data sources, we aim to create a comprehensive tool for urban traffic management and child protection.

Key Objectives and Data Points

To achieve our goal, we focus on specific objectives and gather crucial datasets that inform our predictive model.

Objectives

- Understand traffic, temporal patterns, and road conditions.
- Predict accident likelihood in child-sensitive zones.
- Provide actionable safety recommendations.
- Enhance protection for children and improve urban traffic flow.

Datasets Utilized

- Traffic density, speed, and vehicle movement data.
- School locations, schedules, and pedestrian crossing points.
- Road condition and infrastructure data (signage, crosswalks, speed bumps).
- Historical accident records near schools.

DEVELOPMENT PHASES

Expected Tasks & Deliverables

Our development process involves distinct phases, from data preparation to model deployment, culminating in clear outputs that empower authorities.

01

Data Preprocessing

Feature engineering for spatiotemporal analysis of traffic and environmental data.

02

Model Development

Building predictive models for school-zone accident risk using machine learning.

03

Validation & Evaluation

Assessing prediction accuracy and robustness across various scenarios.

04

Visualization & Recommendations

Graphical representation of high-risk zones and suggested safety measures.

EVALUATION

Measuring Success: Evaluation Criteria

The effectiveness of our AI system will be judged on its accuracy, adaptability, and practical utility for authorities, ensuring it delivers real-world impact.

Prediction Accuracy

Correctness of accident risk predictions in varied conditions.

Temporal & Spatial Handling

Ability to manage variations in time and geographical areas effectively.

Practical Usefulness

Interpretability and actionable insights for urban planning and policy-making.

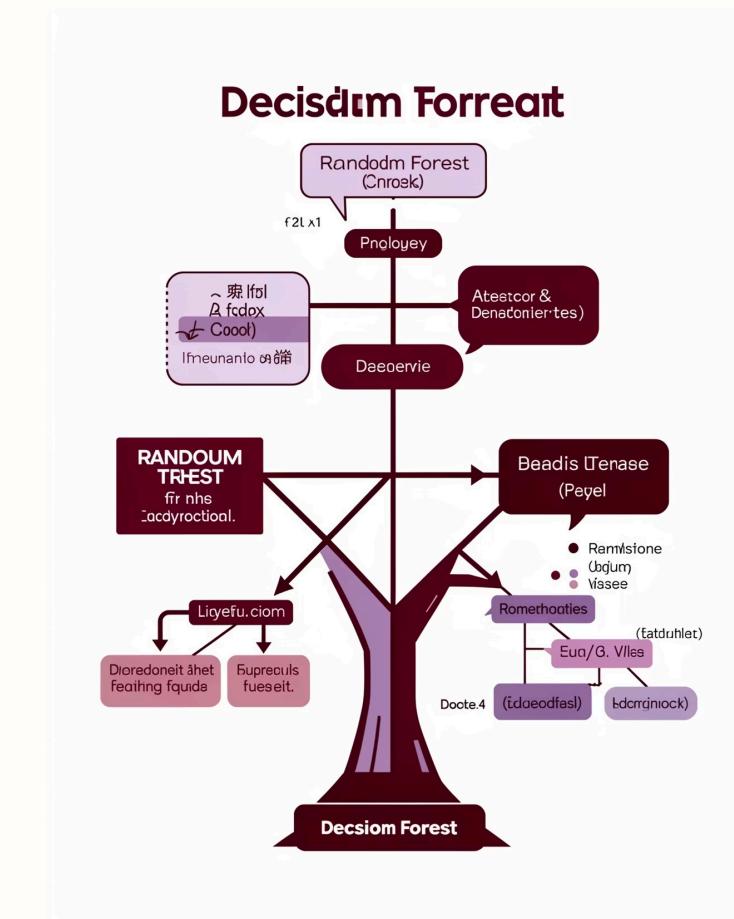
Model Training: Random Forest Classifier

We utilized a Random Forest Classifier for its robustness and ability to handle diverse datasets. The model is trained on synthetic traffic data to predict risk levels.

```
import pandas as pd
import numpy as np
from sklearn.ensemble import RandomForestClassifier

# Data Generation (simplified)
df = generate_data()
X = df.drop('risk_level', axis=1)
y = df['risk_level']

# Model Training
model = RandomForestClassifier(n_estimators=200, random_state=42)
model.fit(X, y)
```



Random Forest models aggregate multiple decision trees to improve predictive accuracy and control overfitting.

Real-time Risk Prediction Interface

The system allows users to input current traffic and environmental conditions, generating an immediate risk assessment and recommended actions. A text-to-speech module provides audible alerts.

Input Parameters:

- Traffic Density (Low/Medium/High)
- Current Average Speed
- Speed Limit
- Road Width (lanes)
- Visibility %
- Is School Hour? (1=Yes, 0=No)
- Signals Present? (1=Yes, 0=No)
- Weather (0=Clear, 1=Rain, 2=Storm)

```
# User input collection
```

```
density_map = {"low": 0, "medium": 1, "high": 2}
```

```
density = density_map[input("Traffic Density: ").lower()]
```

```
speed = int(input("Current Average Speed: "))
```

```
# ... and so on for other inputs
```

```
# Prediction & Confidence
```

```
prediction = model.predict(user_data)[0]
```

```
confidence = max(model.predict_proba(user_data)[0]) * 100
```

ACTIONABLE INSIGHTS

Dynamic Speed Reduction Logic

Based on the predicted risk level, the system provides a recommended speed and a clear justification, enabling immediate adjustments to enhance safety.

Risk Analysis

High Risk: Speed reduced by 30%, capped at speed limit.

Medium Risk: Speed reduced by 15%.

Low Risk: Current speed is acceptable.

```
# Speed Reduction Logic
if prediction == "High":
    recommended_speed = min(speed_limit, int(speed * 0.7))
    reason = "High risk due to current conditions."
elif prediction == "Medium":
    recommended_speed = int(speed * 0.85)
    reason = "Moderate risk detected."
else:
    reason = "Risk level is low. Current speed is acceptable."
```

Outcome: Working, Justified Model

We have developed a theoretically sound and practically implemented AI model for school zone safety. It combines mathematical derivation with a clear Python implementation, providing transparent and actionable insights.



Mathematical Derivations

Core equations, loss functions, and optimization methods are clearly defined.



Working Mechanism

Algorithm learning, data flow, and training/inference processes are well-documented.



Python Implementation

Utilizes standard libraries like Pandas and Scikit-learn for model architecture.



Training Strategy

Detailed hyperparameters, validation splits, and overfitting prevention techniques.

