ROADMETRICS

Changing The Future Of Maps

RoadMetrics Image processing

THE PROBLEM – NOT JUST LOCAL, BUT GLOBAL

There are about 65 million kilometers in roads throughout the world, India alone has over 6 million kilometers in roads

Bad roads and potholes are a major problem and currently, there is no provider that is mapping road conditions at scale!

Over 11,000 people die every year in accidents caused by potholes and bad road conditions in India

(Source: TOI)

(Source: INTERNET)

THE OPPORTUNITY

Roads need to be **regularly monitored** for damages and currently, it is **done manually**!

Current navigation systems only take the shortest path & road traffic into consideration and **do not warn of impending danger zones**

THE SECRET SAUCE

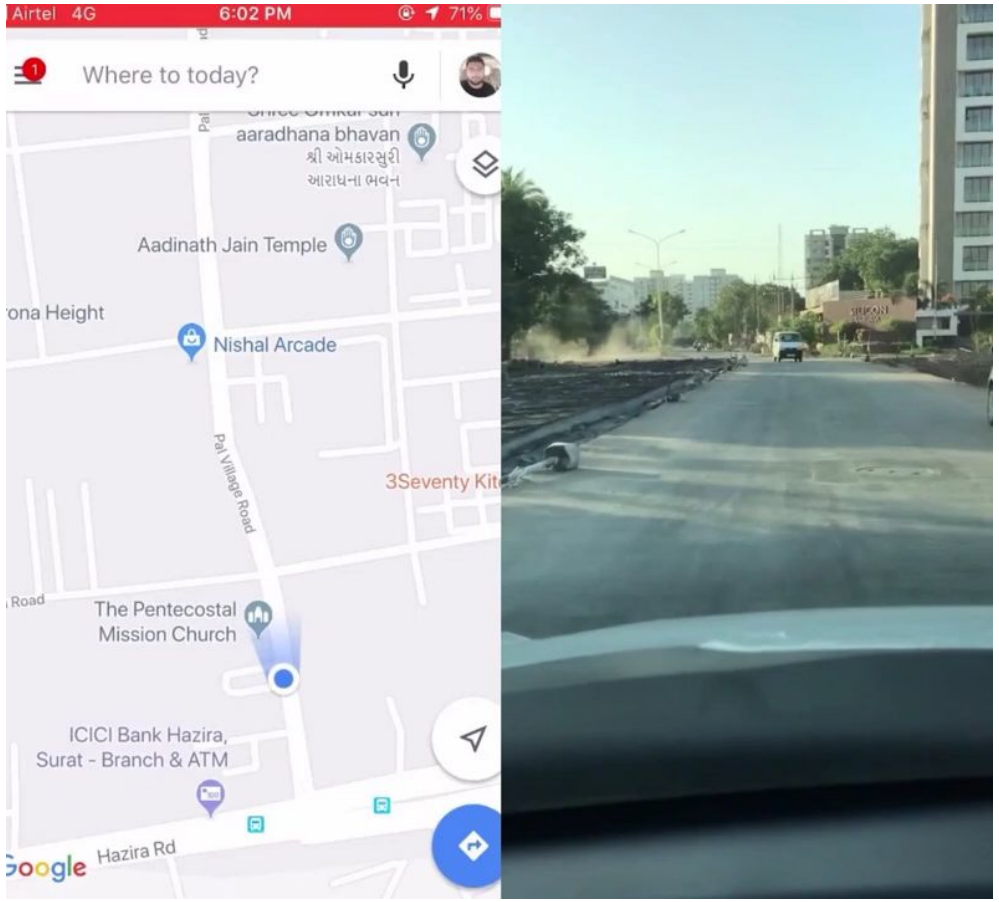
Crowdsourced sensor data from the accelerometer and gyroscope is collected

Image data from our ground fleet/partners is collected periodically

Our sensor data and image data is fused to create a **real time road condition map** and stored in our cloud servers

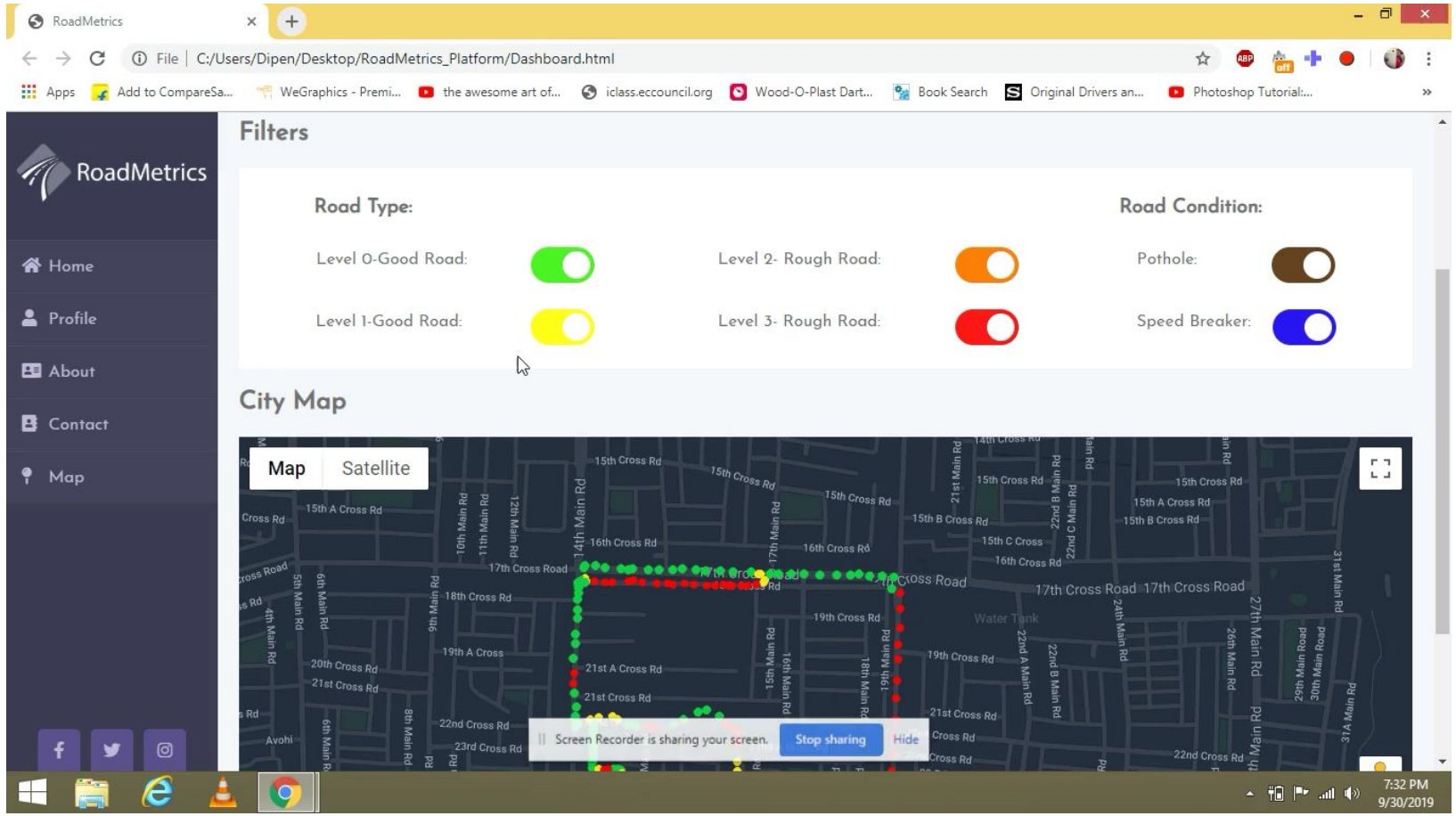
IN ACTION – OUR DEMONSTRATION VIDEO

Our video received over 300,000 views worldwide in less than a week on LinkedIn! Validating our unique solution that can help tackle this large and real problem



This a video demonstrating how sensor data is used to map road conditions

IN ACTION – OUR ENTERPRISE APPLICATION



Government agencies and private infrastructure firms can use this to analyze accurate road condition information.

Image data helps us fill in the missing pieces where our crowdsourced sensor data is unable to identify (such as small potholes usually avoided by motorists)

CRACKS, POTHOLES OR SPEED BREAKERS – WE DETECT IT

Linear Crack (Vertical)

Linear Crack (Vertical) Road construction joint mark

Linear Crack (Horizontal)

Linear Crack (Horizontal) Road construction joint mark

Alligator Cracks

Asphalt Ravelling

Potholes

Speed Breakers

Rutting

Blurred White Line

(Source: GOOGLE IMAGES)

COMPETITOR ANALYSIS

FEATURES	RoadBotics	Google	Apple Maps	RoadMetrics
Road Condition Detection (Sensor)				✓
Road Condition Detection (Image Processing)	✓			✓
Providing Road Data to Governments	✓			✓
Navigation App		✓	✓	✓
Navigate Users according to Road Conditions				✓

OUR TEAM – STRONG ON EXECUTION

Dipen Babariya
Co-Founder/CEO
Handles DevOps and is responsible for the vision of the company. Dipen holds a Bachelor's degree in CS from Sarvajanik College, Surat

Nikhil Prasad Maroli
Co-Founder/COO
Nikhil has worked at Tesla and Velodyne LiDAR in the Silicon Valley and brings unique industry insights. He's previously worked on a startup and also runs a coworking space in Bangalore.
Nikhil holds a Master's degree from Texas A&M University and a Bachelor's degree from RV College Of Engineering

Mishal Jariwala
Co-Founder - CTO/CPO
Mishal is responsible for the tech and product side, including our AI/ML model and oversees tech operations. Mishal holds a Bachelor's degree in CS from Sarvajanik College, Surat

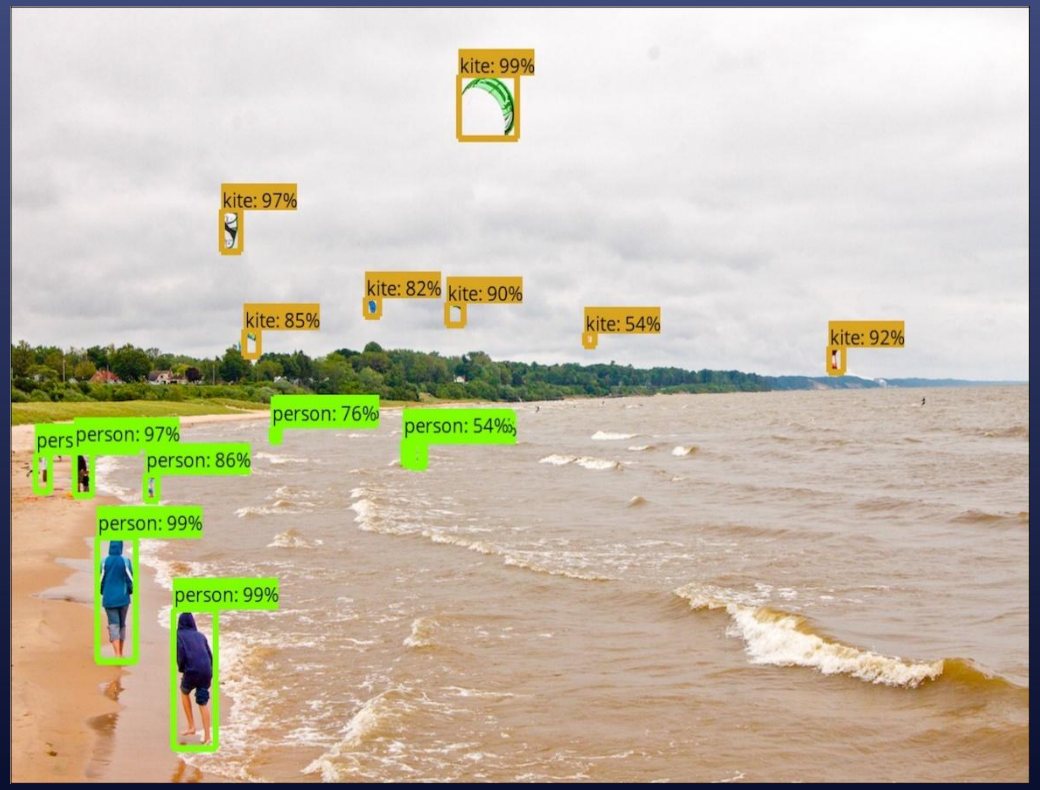
Dharam Chauhan
Our UI/UX contributor. Works at CRED, Design

Why Tensorflow?

Whether you're an expert or a beginner, TensorFlow is an end-to-end platform that makes it easy for you to build and deploy ML models.

Build and train state-of-the-art models without sacrificing speed or performance. The Tensorflow Detection API brings together a lot of the aforementioned ideas together in a single package

Object Detection using Tensorflow



The TensorFlow Object Detection API is an open source framework built on top of TensorFlow that makes it easy to construct, train and deploy object detection models. There are a wide range of pretrained models to choose from according to your needs.

But which model to select?

Model name	Speed	COCO mAP	Outputs
ssd_mobilenet_v1_coco	fast	21	Boxes
ssd_inception_v2_coco	fast	24	Boxes
rfcn_resnet101_coco	medium	30	Boxes
faster_rcnn_resnet101_coco	medium	32	Boxes
faster_rcnn_inception_resnet_v2_atrous_coco	slow	37	Boxes

- There are a ton of different models to choose according to you needs.
- For e.g. We at Roadmetrics needed the highest accuracy with less training time, even though it takes more time to detect objects.
- That's why we used Faster Rcnn model our needs which uses a lot of computational power and is very accurate.
- But, if you want a model which uses less power and provides more speed, you'll have to sacrifice accuracy, this is the case with MobileNet SSD and YOLO.

Creating a custom model using your own database

No database for Indian road conditions and defect was available, so we had to create our custom database by going out and taking photos of the roads.

After that we had to Label each and every Image using a tool named Labelimg where we tell the machine learning model which area of the image to focus on and how to classify it.

Your Database should have images with objects is different scenarios, such as in evening or day, from different angles, etc.

Steps for training your model

1. Gather Pictures and Label Them.
2. Split the labeled images in 80/20 ratio , put 80% in training folder and 20% in testing.
3. Generate training data. Convert the training and testing files to csv. File for converting are already available in Tensorflow Object detection API.
4. Generate TF records using the csv files which will be used by the training module.
5. Create a Label map with all the classes you want to classify the objects into.
6. Run the training. Training time for MobileNet SSD is generally 8X more than faster rcnn.
7. Export Frozen inference graph of your model and test it !
8. https://github.com/EdjeElectronics/TensorFlow-Object-Detection-API-Tutorial-Train-Multiple-Objects-Windows-10

Model: Faster-RCNN-Inception-V2
Training Time: 3 hours

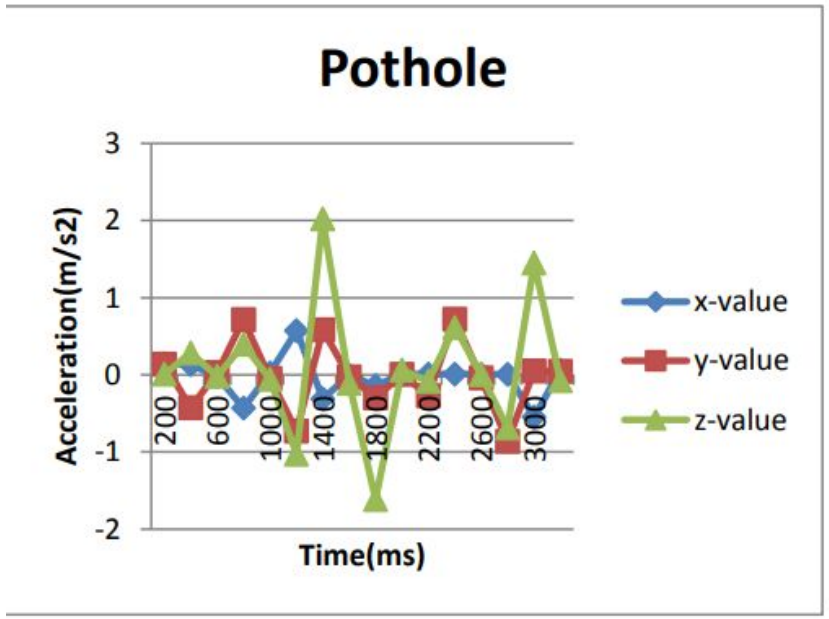
Model: MobileNet-SSD-V1
Training Time: 8 hours

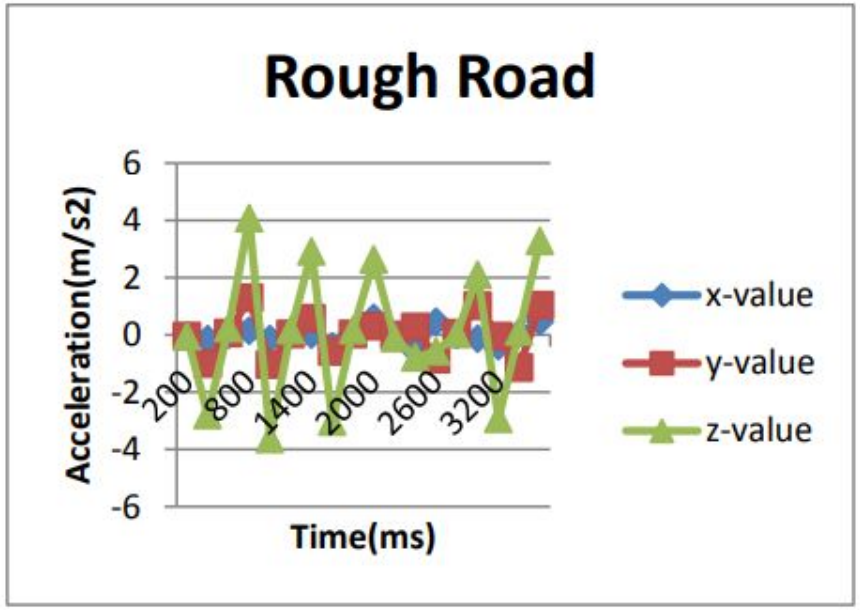
Some Sample images of Our Detection Model.

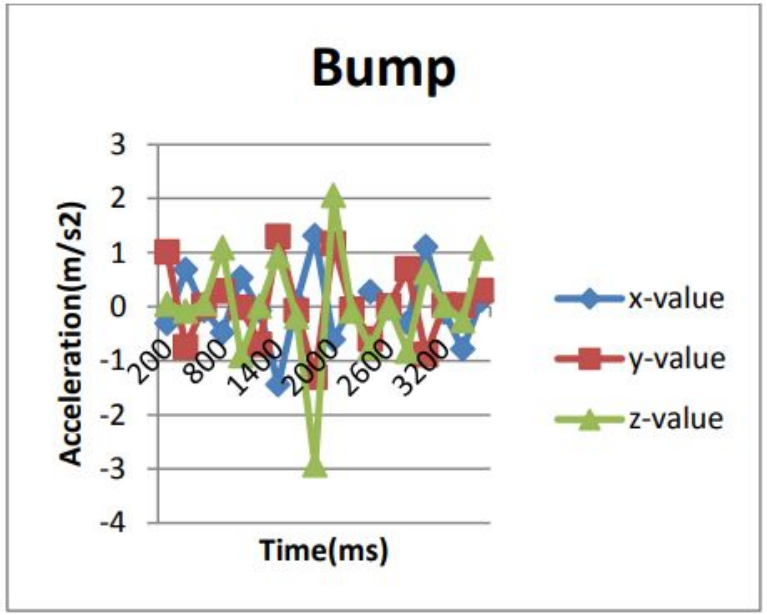
Sensors

Every Smartphones Have Sensors like Accelerometer and Gyroscope. But We Don’t know that this sensors are capable to capture every small vibration. So We use this Sensors to Replicate our feelings when we encounter potholes or Bad Road Condition in our journey.

Sensor Patterns For Different Road Conditions

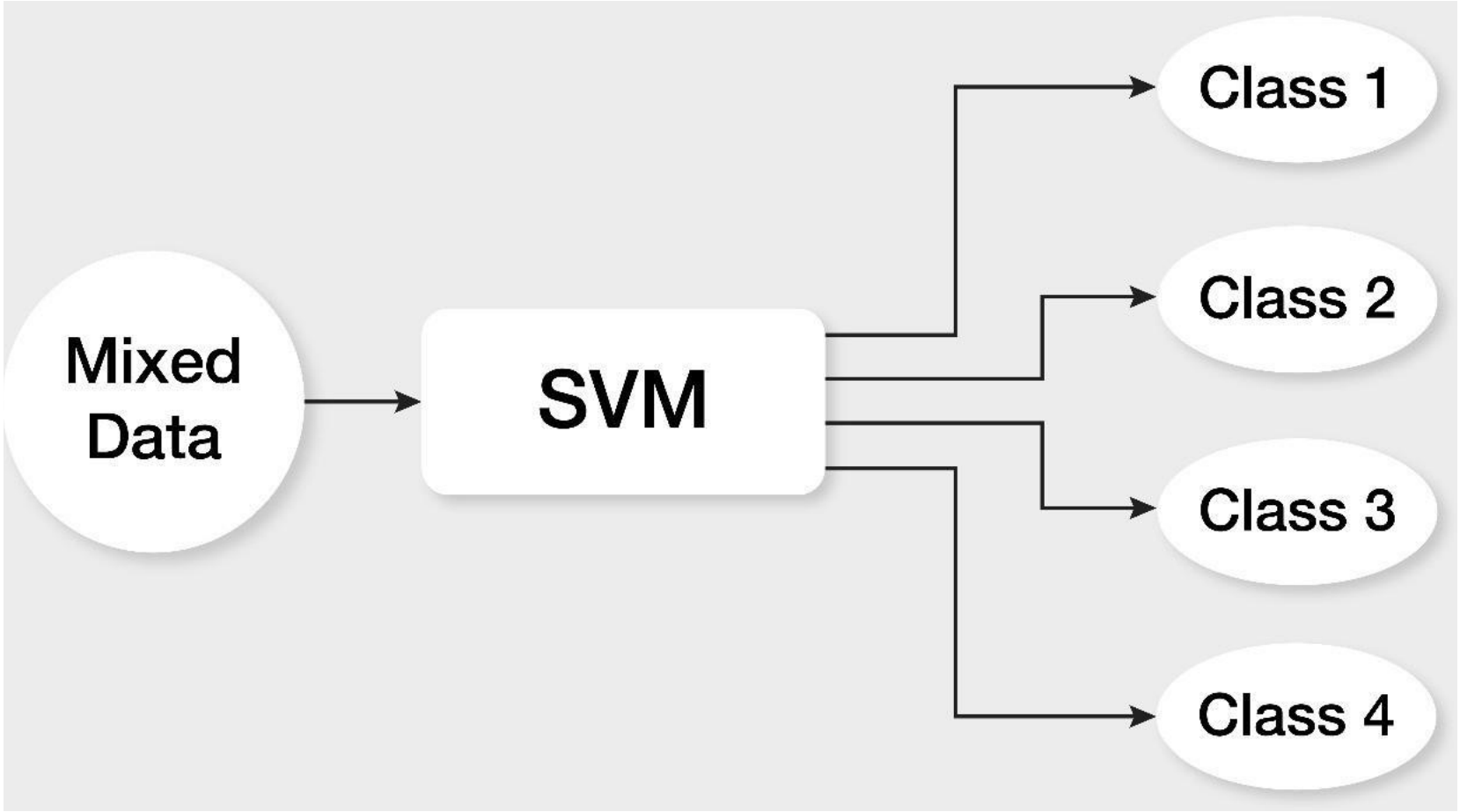






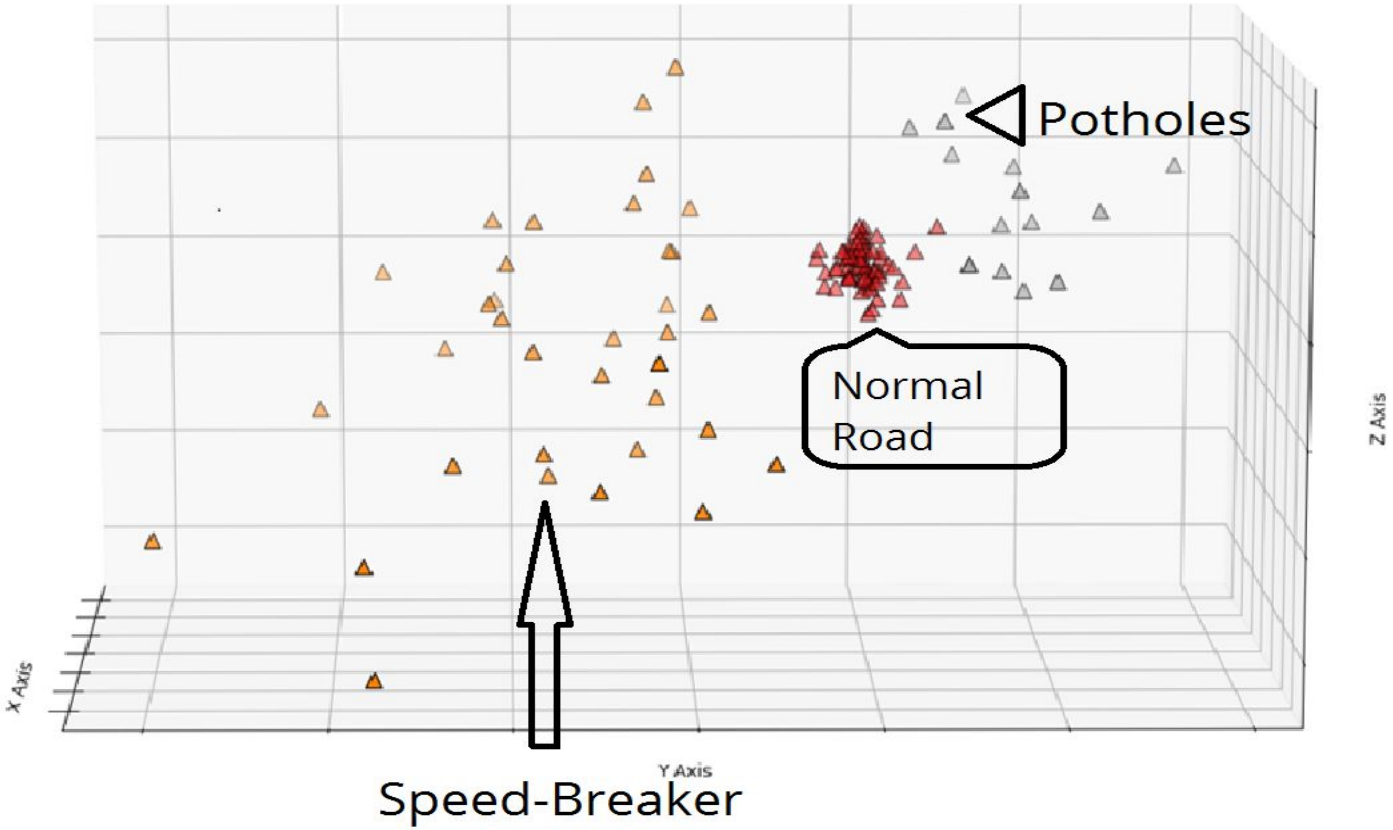
What's Happening in the App Background

SVM Classifier (ML Algorithm)



Trained SVM Model

Scatter Map of Pre-processed Data with Accuracy




```
For Poly:- 97.25274725274726 %
For RBF:- 99.45054945054946 %
For Linear:- 97.8021978021978 %
For Logistic:- 97.8021978021978 %
For Decision Tree:- 100.0 %
For Decision Regression:- 100.0 %
```