Tyre Inspection Using Deep Learning and Image Processing

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Outline

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Introduction

Motivation

- Common People are regular users of cars and most of them don't have a clear idea about health of tyres.
- The users only notice in the end when there is no tread left on the tyres or when they skid off.
- The only way of knowing more about tyres condition is to meet up with an expert.
- Most of the wear on the tyres can be minimized by proper care and timely adjustments from the user side.

Introduction

Motivation

According to the Crash Stats report[3] "The tyre problem accounted for about 35 percent of the crashes" where vehicle failures were the cause of the crash. This makes tyre failure the most common cause of a vehicle failure crash.

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Introduction

Scope

- This projects scope extends out to all car users and drivers as well repair men through out the world who, wishes to have a handy and accessible as well as a reliable tool to gauge the health of their tyres.

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- This projects scope extends out to all car users and drivers as well repair men through out the world who, wishes to have a handy and accessible as well as a reliable tool to gauge the health of their tyres.
- This project works based on deep learning principles using deep neural networks combined with image processing. So every time a user uses the product, the accuracy increases.Thus with more number of users, accuracy and the diversity of tyres increases rapidly.

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Introduction

Objective

The primary aim of this project is to successfully develop a deep learning model which predicts defects on tyres, of which the data is made available through the feature extraction methods of image processing technology. The model will be trained to have an accuracy over 95 percent and the trained model will be made available to the users in the form of an android application.

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Tyre Pressure Checking App

This is an Ios based application which scans the side view of the tyres and calculates its tyre pressure and finds if its under pressure or over pressure. But this system can't ascertain the wear and tear of the tyre. Also it is said to have a precision of near 2psi so the reading will be off by 2 psi from the real value. Also it is not easy to scan the tyre with this software and tilts and turns will cause results to vary.

Hand Held Tread Reader

This is a small piece of hand held equipment which is used to scan the tyre treads and create a 3d model of the tread. The device connects to a mobile through WIFI and the results of the scans are available in printable form in the mobile application. The main problem with this technology is the need for additional hardware. It is a bit bulky and also costly. Hence mostly only professionals will be mostly using it.

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Proposed System

Proposed System Working

The primary part of this project is the deep neural network. It is this network which does all the processing work. The data required by the neural network will be extracted from the images of the tyres obtained from the smart-phone camera through feature extraction techniques in the image processing technologies. Huge amount of data will be collected before-hand to train this neural network to the required accuracy. After the trained network will be ported to android platform and will be made available to users.

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Proposed System

Possible Implementation Risks

- There are many risks which might happen during the implementation of this project. most of the deep learning frameworks exist in Python or R language. But problem arises when porting these programs to Android platform. Because Android does not support these languages implicitly.
- Another problem is the performance issue. Since deep neural network contains huge number of neurons, it will take more time to process normally and even more time to actually train it.

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Proposed System

Possible Solutions to Risks

- The problem with the porting of neural network to android as well as performance issues can be solved by implementing in C++.
  By implementing in C++, we can build for Android through Android-NDK. Also since C++ programs has more performance than Python or R programs and C++ programs can be accelerated by programming in CUDA or OpenMP or OpenCL, it solves the performance issues.

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Proposed System

Proposed System Implementation Plan

- By taking in to consideration the working of the system, the possible risks during implementation and its solutions, it was decided to divide the proposed system to mainly 3 parts.
  - Platform Interface: The interface between the android platform and all other modules. It captures the images and passes it to other modules and takes output from other modules to the user.
  - Image Processing Module: This part is responsible for feature extraction from the input images. It will be implemented using OpenCV framework.
  - Deep Learning Module: This part is responsible for processing the data and obtaining the results. the neural network lies in this module.

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Proposed System

Implementation Done Till Now

- A neural network framework was created using C++ from scratch.
- The neural network was tested by training for acting as XOR function and the network attained more than 99 percent accuracy.

Expected Results

- The Main result of this project will be a full functional mobile application which is able to recognize and predict the wear and tear of tyres with high accuracy and low error rates.

Expected Results

- This project we discussed here is a way to improve the health of the tyres of vehicles. By improving the tyre condition, accidents can be decreased and the maintaining cost of tyres can also be minimized. Along with that, the life of the tyres will increase. Besides the product discussed here is available for all the users of the android based smart phone. So anyone can use it.

Future Work

- The application can be enhanced by adding more and more types of tyre recognition functions
- More number of users will use it, if it is also ported to Ios.
- As the number of users increases, the neural network learns more and more. Hence its accuracy increases. Also new and newer tyre patterns will be learnt by the network.

References

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