Advanced Crash Detection

The Road from Development to Production

Steve Cowper
Telematics Product Manager
About the RAC
Our History

Founded by Charles Harrington Moore and Richard Simms as the Automobile Club of Great Britain

Club received royal approval from Edward VII and became the Royal Automobile Club (RAC)

The group began the British Grand Prix, held at Brooklands

The group was incorporated as RAC Motoring Services

RAC was the first organisation to introduce flexible hours for its patrol force

First breakdown provider to deliver technical diagnostics from patrol fleet to manufacturers. Developed the Universal Wheel

Diversified into Telematics, Accident Management

The Club began employing the first uniformed patrolmen in the UK

Began offering legal services

Introduced roadside emergency telephone boxes

Sold by members to Lex for £437m in July 1999

Developed the rapid deployed trailer (RDT) increasing efficiency and enabling more patrol, rather than contractor, tows

Acquired by Aviva for £1.4bn in May 2005

2011 Acquired by the Carlyle Group. Sponsored the first Future Car Challenge focusing on environmental issues in motoring

Motorists. We salute you.
About the RAC
Strategic Product Development

More than just a breakdown provider

- Accident Management
- Fuel Card
- SME Fleet Management
- Garage Networks
- Servicing
- Body repairs
- Telematics & Insurance products
- Data Services
- Buying & Selling Cars
- Internet shop for motoring products
Motorists. We salute you.

RAC Telematics
What is Telematics?

GPS Satellites
- Timestamp
- Latitude
- Longitude
- GPS Speed
- Heading
- Location accuracy

Event Driven data packets via GPRS
- Ignition on / off
- Timed driving event
- Idle start / stop
- Hard acceleration / braking
- Crash event with high frequency GPS and accelerometer data

Data derived from unit
- All GPS data & distance driven
- 3 axis accelerometer
- OBD II data
  - Vehicle data
  - DTC
  - Extended data

RAC AWS Platform
- Reverse Geocoding
- Speeding check
- Web portal
- Journey reporting
- Fuel reporting
- Vehicle diagnostics
- Predictive maintenance alerts
- Driver behaviour score
- Crash reporting
RAC Telematics Strategy

Become the market leading provider delivering solutions for:

- Vehicle manufacturers – connected car
- Insurance providers – technology partner
- Fleet owners – fleet insight
- Individual drivers and consumers – member benefits

Strategic drivers:

- Low cost infrastructure
  - Opening up markets where current solutions are cost prohibitive
- Simplicity
  - Rapid installation without loss of information access
- Flexibility
  - Information access through multiple channels
RAC Telematics
A system of innovation

➤ A legacy-free solution built for the best in quality and functionality at the lowest possible cost of service delivery

➤ Single, highly flexible device
➤ Vehicle activity
➤ Driver risk (incl instant notification of accidents)
➤ Vehicle health and diagnostics

➤ Rapid Installation
➤ Hard wired or plug-in
➤ Over-the-air configuration
➤ Pre-installed global SIM

➤ Cloud based platform
➤ Robust and scalable
➤ Information access via portal, reports or apps
➤ Data integration through API or data feeds

Motorists. We salute you.
Overview of Insurance Telematics

Aim is to deliver:

- Personalised insurance pricing
- New insights into driver behaviour
- Better control of risk and claims costs for insurers
Scoring algorithms developed using MATLAB
Scoring algorithms developed using MATLAB

50 x performance increase from using

- Parallel Computing Toolbox
- Datastore
- MapReduce
Insights into Driver Behaviour

average of all driver scores by month

Average score in month of crash

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Why is crash detection important?

- Crash detection provides rapid response.
- Duty of Care.
- Mitigation of claim costs.
- Residual value.
Example of benefits of crash detection

Motorists. We salute you.
The next morning…
<table>
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<td>60 mph</td>
<td>7.3g</td>
<td>17/09/2014</td>
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**URGENT ATTENTION REQUIRED**

G-force at point of impact:
- FWD: [Graph]
- LEFT: [Graph]
- RIGHT: [Graph]
- DOWN: [Graph]
- UP: [Graph]
Accident Management / Telematics

**VEHICLE / INCIDENT DETAILS**

- Reg. No: [Redacted]
- Make: [Redacted]
- Model: [Redacted]
- Pol. No: [Redacted]
- Street: A635
- Town: Holmfirth
- Post Code: HD9 2
- Speed Limit: 60 mph
- Severity: 7.36 g
- Time: 17:59 26/12/2014

**Vehicle Speed: 95 seconds around point of incident**

Click here to open location in Google Maps (Red Arrow)
The Challenges of Crash Detection

RAC wanted to deliver a ‘game changing’ solution

Despite the challenges…

Reliable Detection of Low Speed Crashes

Easy to understand for non expert users
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False positive triggers
The Challenges of Crash Detection

RAC wanted to deliver a ‘game changing’ solution

- Reliable Detection of Low Speed Crashes
- Easy to understand for non expert users

Despite the challenges…

- Small micro due to cost constraints
- False positive triggers
The Challenges of Crash Detection

RAC wanted to deliver a ‘game changing’ solution

Despite the challenges…

Reliable Detection of Low Speed Crashes

Easy to understand for non expert users

Streaming of all data not practical

Small micro due to cost constraints

False positive triggers
The Solution

RAC wanted to deliver a ‘game changing’ solution

Developed new onboard crash sensing - ACD1
Reliable Detection of Low Speed Crashes
Easy to understand for non expert users

Despite the challenges…

Streaming of all data not practical
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RAC wanted to deliver a ‘game changing’ solution

Deploy server based analytics and classification – ACD2
Developed new onboard crash sensing – ACD1
Reliable Detection of Low Speed Crashes
Easy to understand for non expert users

Despite the challenges…

Streaming of all data not practical
Small micro due to cost constraints
False positive triggers
G forces generated by types of incident

- High Speed Crashes
- Medium Speed Crashes
- Low Speed Crashes

Competitor A
4g Crash Threshold
G forces generated by types of incident

Motorists. We salute you.
G forces generated by types of incident

- **High Speed Crashes**
- **Medium Speed Crashes**
- **Low Speed Crashes**

**CRASH EVENTS**

**RAC g Threshold**

Motorists. We salute you.
G forces generated by types of incident

Motorists. We salute you.

CRASH EVENTS
- High Speed Crashes
- Medium Speed Crashes
- Low Speed Crashes

FALSE POSITIVES
- Mini Roundabouts
- Speed bumps
- Hard Braking

G forces generated by types of incident:
- High Speed Crashes: 2g to 4g
- Medium Speed Crashes: 1g
- Low Speed Crashes: 1g

Vehicle experiences g-forces ranging from -7.5g to +7g on the lateral axis.
RAC ACD1 – suppressing false positives
RAC ACD1 – suppressing false positives
ACD2 Event Flow

- Device triggers crash event & sends OTA
- Socket Server receives crash data
- .NET environment call to ACD2 DLL

Preprocess signal

Extract features from signal using Wavelet decomposition

Compare against pre-trained Machine Learning classifier

Output classification with a confidence back to .NET environment

ACD2 results received as output

PDF constructed using output

FNOL PDF emailed to relevant recipients
Example of clustering data

Example of good separation

Example of poor separation
Collision location and speed graphs: Click here to view in Google Maps.
End Result
End Result
G forces generated by types of incident

- High Speed Crashes
- Medium Speed Crashes
- Low Speed Crashes
- Mini Roundabouts
- Speed bumps
- Hard Braking
G forces generated by types of incident

CRASH EVENTS

FALSE POSITIVES

- High Speed Crashes
- Medium Speed Crashes
- Low Speed Crashes
- Mini Roundabouts
- Speed bumps
- Hard Braking

Suppressed by ACD1 & 2
In summary

Working with MathWorks has enabled:

- Rapid data analysis during development of ACD1 solution
- A toolset for developing ACD2 which within a unified environment for:
  - signal processing
  - machine learning algorithms
- Easy deployment of these tools into existing AWS / .NET based environment

Validation

Transport Research Laboratory (TRL) carried out a series of tests of low speed crashes and driving over road features to independently validate the RAC Telematics solution. Results showed the RAC system to be 92% accurate in detecting test crashes and filtering false-positive notifications.