Advanced Crash Detection

The Road from Development to Production

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About the RAC
Our History

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

- **1897**: The Club began employing the first uniformed patrolmen in the UK.
- **1901**: Began offering legal services.
- **1905**: RAC was the first organisation to introduce flexible hours for its patrol force.
- **1907**: The group began the British Grand Prix, held at Brooklands.
- **1912**: The group was incorporated as RAC Motoring Services.
- **1926**: The group received royal approval from Edward VII and became the Royal Automobile Club (RAC).
- **1932**: RAC was the first breakdown provider to deliver technical diagnostics from patrol fleet to manufacturers. Developed the Universal Wheel.
- **1978**: First breakdown provider to deliver technical diagnostics from patrol fleet to manufacturers. Developed the Universal Wheel.
- **1998**: The Club began employing the first uniformed patrolmen in the UK.
- **2000**: Developed the rapid deployed trailer (RDT) increasing efficiency and enabling more patrol, rather than contractor, tows.
- **2002**: Sold by members to Lex for £437m in July 1999.
- **2005**: Acquired by Aviva for £1.4bn in May 2005.
- **2009**: Acquired by the Carlyle Group.
- **2010**: Sponsored the first Future Car Challenge focusing on environmental issues in motoring.
- **2011**: Acquired by the Carlyle Group.
- **2012**: Diversified into Telematics, Accident Management.
- **2014**: Developed the Universal Wheel.
About the RAC
Strategic Product Development

REACTIVE BREAKDOWN MODEL  ➤  PROACTIVE INTEGRATED SERVICES MODEL

Technical Excellence Breakdown  Quality Management Telematics  Data Management Data  World Class IT Infrastructure Repair Services

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.
What is Telematics?

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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
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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
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

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Scoring algorithms developed using MATLAB

50 x performance increase from using

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

Average score in month of crash
Insights into Driver Behaviour

average of driver scores by month

- Policy incepted >90 days
- Policy incepted <90 days

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Why is crash detection important?

Crash detection provides:
- Duty of Care
- Mitigation of claim costs
- Rapid response
- Residual value
Example of benefits of crash detection
The next morning…
FIRST NOTIFICATION OF LOSS - COLLISION ALERT

URGENT ATTENTION REQUIRED

REG/INCIDENT DETAILS

Reg. No.: [redacted]
Make: [redacted]
Model: [redacted]
Pol. No.: A003
Street: Harefield
Town: Harefield
Post Code: HD9 2
Speed Limit: 60 mph
Severity: 7.35 g
Time: 17:59 20/12/2014

G Force at point of impact:
FWD: [redacted]
LEFT: [redacted]
DOWN: [redacted]
RIGHT: [redacted]
UP: [redacted]
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
The Challenges of Crash Detection

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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…

- Streaming of all data not practical
- Small micro due to cost constraints
- False positive triggers

Reliable Detection of Low Speed Crashes

Easy to understand for non expert users
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
- Small micro due to cost constraints
- False positive triggers
The Solution

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

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

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High Speed Crashes

Medium Speed Crashes

Low Speed Crashes

CRASH EVENTS

FALSE POSITIVES

Competitor B
2g Crash Threshold
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G forces generated by types of incident

- High Speed Crashes: 4g
- Medium Speed Crashes: 2g
- Low Speed Crashes: 1g

RAC g Threshold
Motorists. We salute you.

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

Vehicle experiences g-forces ranging from -7g 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
End Result
Motorists. We salute you.
End Result
Motorists. We salute you.

End Result
G forces generated by types of incident

- **High Speed Crashes**: 0.7g
- **Medium Speed Crashes**: 2g
- **Low Speed Crashes**: 4g

**FALSE POSITIVES**
- **Mini Roundabouts**: 37g
- **Speed bumps**: 22g
- **Hard Braking**: 0.7g
G forces generated by types of incident

CRASH EVENTS

FALSE POSITIVES

High Speed Crashes

Medium Speed Crashes

Low Speed Crashes

0.7g

2g

4g

g

Mini Roundabouts

Speed bumps

ACD1 & 2

Suppressed by

Hard Braking
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.