The rise in the use of data and algorithms in traditional industry workflows

Cliff Brereton
Director
Topics for today

1. About us
2. The use of Data, Analysis and Statistics in Industry
3. Specific use cases
4. The future
Who are OCF?

- Sheffield HQ
- UK’s premier builder of High Performance Computing
  - On premise
  - Cloud
- 45 Employees
- £21M Turnover
- Profitable
- Privately owned

ISO 27001
Value from the Intersection of Business Processes & Data Science

Private Sector
- More ‘top line’ Sales
  - Acquire & Retain more customers
  - Best client service
  - Understanding their clients needs
  - Products and services that match / exceed customer needs
- More ‘bottom line’ Profits
  - More efficient delivery
  - Faster / Better / Leaner
  - Reduced time to value
  - Higher quality / more reliable

Public sector
- Serve customers better
  - Understanding their customer needs
  - Broader / personalised range of services
  - Services that match / exceed customer needs
  - Taxpayer value for money
- Doing more with less
  - Optimal resource management and highly leveraged assets
  - Appropriate use and efficient execution of finance
  - Avoid waste
  - Skilled and motivated workforce
  - Compliant and auditable processes

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Data characteristics by Industry

1. Consultants
2. Fast storage
3. Hadoop Clusters
4. Enterprise Analytics Software

Industry ‘Itches’

- More with less
- Improve patient outcomes
- Financial sustainability
  - Recruit & Retain
  - Widen research base
- Low Productivity
- Industry 4.0
- Regulation
- Renewal

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**Data Analytics Continuum**

**Prescriptive** – What do I do?
- Best actions based on probabilities
- Learned behaviour

**Predictive** – What is likely to happen?
- Forecast informed by the past
- Numerous data sets and attributes

**Diagnostic** – Why is it happening?
- Root cause analysis
- Trends / Outliers

**Descriptive** – What’s happening?
- Business Intelligence
- Visual analytics

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Commercial Software Developers

Figure 1. Magic Quadrant for Analytics and Business Intelligence Platforms

Source: Gartner (February 2018)
Examples of models available

IBM Watson Studio

- Association Rules
- Auto Classifier
- Auto Numeric
- Bayesian Network
- C5.0
- C&R Tree
- CHAID
- GLE
- Linear
- Linear-AS
- LSVM
- Random Trees
- K-Means
- KNN
- Cox
- PCA/Factor
- Anomaly
- Feature Selection
- Tree-AS
- Sequence
- SVM
- Isotonic-AS
- Logistic
- Neural Net
- K-Means-AS
- TwoStep-AS
- TwoStep
- Time Series
- Kohonen
- Decision List
- One-Class SVM
- Apriori
- Discriminant

SAS Enterprise Miner

- Clustering
- Feature Extraction
- Filtering
- Imputation
- Manage Variables
- Replacement
- Text Mining
- Transformations
- Variable Clustering
- Variable Selection

- Supervised Learning
- Bayesian Network
- Decision Tree
- Forest
- GLM
- Gradient Boosting
- Linear Regression
- Logistic Regression
- Neural Network
- SVM
- Postprocessing
- Miscellaneous
Health
in the News

The Guardian
NHS deficit last year twice as high as expected, say sources

The News
NHS report reveals sharp rise in waiting times for care

QA Hospital chest x-ray backlog that saw two patients die was ‘within accepted error rate’

EXPRESS
Bed blocking costs NHS £3 billion a year

Portsmouth hospital A&E care delays put ‘patients’ lives at risk’

DevonLive
Nearly 3,000 bed-days lost because of bed-blocking but Torbay still among best in the country

Plugging the black hole in NHS funding plan
Offerings

A&E 360° Analytics
Predict demand in A&E (month/week/day/shift) with >80% accuracy for volumes and modality.
1. Optimise resources / capacity
2. Faster throughput / time to treatment / Targets
3. Better patient outcomes
4. Better short and long term planning

Testing resource optimisation Analytics
Analyse and optimise performance of Radiology and Pathology testing resources (facilities / machines / staff)
1. Reduce request variances
2. Better utilised assets
3. Capital avoidance / delay
4. Faster throughput
5. Better patient outcomes

Predictive DTOC Analytics
Predict upon arrival whether patient will be a 'delayed discharge' to >90% accuracy
1. Early visibility
2. Earlier intervention / Quicker resolution
3. Free up capacity
4. Increase throughput
5. Better patient outcomes

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Predictive DTOC Analytics
University Hospitals Coventry and Warwickshire NHS Trust (UHCW) operates from three hospital sites in the West Midlands, providing both emergency and elective care to the local community, employing 10,000 staff that is responsible for managing over 1,100 beds and 35 operating theatres.

Like at NHS providers, UHCW sees increasing demands on its services from a growing and ageing population. As a result, UHCW’s focus was to improve patient outcomes while controlling costs more effectively.

The 2015 Cumber Review highlighted the need to remove unwanted variances from the system in order to better manage processes, costs and budgets. Testing facilities in radiology or pathology are used for most patients attending the hospital, so it is essential that they operate efficiently to avoid bottlenecks or waste, particularly as changes from these services are several billion pounds in nature.

To help identify opportunities for improving both patient care and cost savings, UHCW needed to look at the large volumes of data it produces throughout the services it provides.

OCF data (left) is a workflow, process and performance optimisation provider, delivering measurable performance gains through the use of data analytics, business intelligence and technology to help organisations achieve their strategic goals.

The data is used to identify outliers and generate automated alerts to managers and staff, helping to improve efficiency and reduce costs. OCF data has helped the trust to improve patient outcomes and reduce costs by 10%.

Analysing the data is a continuous process, and the team is always looking for new ways to improve services and reduce costs.
A&E Wait-times

Source: Kings Fund, 2018
Resignations send stark warning to chief execs on A&E performance

Two acute trust chief executives have resigned today under pressure from ministers and NHS Improvement over consistently poor accident and emergency performance.

The following trusts missed the target in each of the first five months of 2017-18:

East Kent:
- East Kent and Canterbury University FT
- Princess Alexander Hospital Trust
- Portsmouth Hospitals Trust
- United Lincolnshire Hospitals Trust
- Shrewsbury and Telford Hospital Trust
- Wythenshawe Hospital Trust
- Wiltshire University Teaching Hospital FT
- North Midlands Trust
- Weston General Hospital Trust

North Middx:
- North Staffordshire FT
- Arlesey Healthcare
- Ealing Healthcare Trust
- Gracelands Hospital FT
- University Hospitals Oswestry and Shrewsbury Trust
- West Suffolk Hospital Trust
- East Lancashire Hospitals Trust
- Bournemouth FT
- Heart of England FT
- North Central and East London FT

Improvement tool

East Kent

North Middx
Internal Data

- Accident and Emergency (A&E) Hospital Episodes Statistics
  - Arrival Mode
  - Attendance Category
  - Attendance Disposal
  - Attendance Number
  - Department Type
  - Patient Group
  - Age of Arrival
  - Arrival Data/Time
  - Departure Data/Time
  - A&E Diagnosis
  - A&E Investigation
  - A&E Treatment
  - Duration to treatment
  - Wait-days
  - Postcode
  - IMD Index of Multiple Deprivation
  - Registered GP

- Admitted patient Care
  - Admission Method
  - Administrative Category
  - HRG code for Episode
  - Source of Admission
  - Patient Classification
  - Consultant Code
  - Date of discharge
  - Diagnosis
  - Destination on discharge
  - Method of discharge
  - Episode duration
  - Main specialty

- Outpatient
  - Treatment specialty
  - Duration of wait
  - RTT period
  - HRG code for Attendance
  - Source of referral
  - Patient pathway identifier
  - Main specialty
  - Diagnosis
  - Attendance type

- Estates Return Information Collection (ERIC)
  - Facilities Management services
  - Function and Space

- Workforce
  - Staff management
  - Staff numbers

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External Data

- Weather
  - History
  - Forecast
- Flood
  - History
  - Prediction
- Roads (history and current)
  - Accidents
  - Conditions and roadworks
  - Traffic
  - Major accident reports / enquiry findings
- Calendar
- Events Calendar
- Social Media Alerts & Trends

- Ambulance data
- Seasonal admissions data
- GP attendance
- Community care provider data
- Epidemic data
- Seasonal trend data
- Curated academic publications (e.g. PubMed)
- Government publications

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Basic

207
+9.6%
#27th

Condition / Urgent

Sex / Age

Treatment Type

Attendance Disposal

7 Day Trend

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Manufacturing & Industry 4.0
- Platarg ‘Transfer Press’
- Made in London
- 1984
- 200 PPM
- 6 Tons per Station
- 11 Stations
- £140,000
- Manufacturers
  - Battery cases
  - Pen bodies
  - Lipstick cases
  - Bullets

NEW 612 REPLACES 611
Tooling Interchangeable!
Improvements include:
- Extra stage i.e. 13 stations in total.
- Larger main frame.
- Increased diameter main shaft and wider keys.
- One piece pressure and lifter arms.
- Redesigned clutch, large brake.
- More powerful drive, 15HP motor.
- Variable pitch pulley drive with push button control.
- Full follow blank hold down arms.
- Roll feed with pneumatically loaded top roll ensures even roll pressure.
- Frame machined to accept stagger feed if required at a later date.
- Spiral main drive gears.
- Full follow arms on blanking stage.
- Modified scrap chopper simplifies blade replacement.
- Quick release multi pin electrical connectors.
- Larger coolant tank.
- Counter balance weights fitted to rising guards.
- Digital speed indicator.

Available options:
- Beading/Threadrolling unit.
- Stagger feed for double row blanking increased material economy.
- Mk. 2 high speed cams and roller type lifter arms.
- High pressure coolant pump and filter.
- Mechanical/pneumatic pressure sleeves.
- Turnover mechanism.
- Die blocks keyed to bolster.
- Bottom shaft overload clutch in addition to standard side shaft clutch.
- Transfer slide finger setting jig and finger machining jig.
- Spring box ejectors.
FAIL-LESS

**Connect**
- Fast connection to any sensor, device and machine controller
- Full data interoperability across machines using MTConnect and MODBUS standards
- Archival of all historical data on scalable on-premise servers or in a private cloud
- Real-time management of various data inputs and connectivity

**Monitor**
- Real-time monitoring of condition, production and consumption metrics
- Automated alerts and recommendations on machine health status
- Timely decision-making using in-app messaging, sharing and reporting
- Customizable monitoring dashboard and fault detection models

**Diagnose**
- Artificial intelligence applied to fault detection and prediction
- Automated analysis of fault root causes and fault signature pattern matching
- Automated or ad-hoc testing and reporting of fault diagnosis
- Archival of all fault pattern signatures to track degradation and enhance analytics

**Predict**
- Artificial intelligence applied to reliability and severity forecasting
- Automated or ad-hoc analysis of machine component degradation and lifecycle
- Triangulation of information for producing robust and accurate forecasts
- Enhance quantifiable insights in support of maintenance planning activities
FAIL-LESS Business Model

1. FAIL-LESS will offer a SME business owner the opportunity to collect machine sensor data at a relative low cost and expose this to a cloud service, using machine AI to determine maintenance and operational insight.

2. FAIL-LESS will offer the ability for MRO workshops and Service Agents insight (at cost) to understand the maintenance and repair requirements of the SME business via the FAIL-LESS cloud platform.

3. FAIL-LESS will enable MRO part suppliers the ability to interface with new clients and service agents, whilst holding less inventory due to better insight.

The platform has the ability to create new service level relationships.

Sell knowledge from Machine Learning to provide insight to Spares Manufacturers

Supply of Spares into MRO Marketplace

Supply of Spares directly into Customers

E-commerce Marketplace Platform

Machine Learning Predictive Maintenance

FAIL-LESS Platform

New Service Agent

Being Service Agent

Client Legacy Machines

3rd Party MRO workshops

Spares

Data

Knowledge (£)
Colchester Bantam 1956
Overall Equipment Effectiveness

OEE = Availability x Performance x Yield

<table>
<thead>
<tr>
<th>Availability</th>
<th>Performance</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unplanned downtime</strong></td>
<td><strong>Low Throughput</strong></td>
<td><strong>Low Quality</strong></td>
</tr>
<tr>
<td>• Machine failure / repair</td>
<td>• Operator</td>
<td>• Operator failure</td>
</tr>
<tr>
<td>• Tool failure / repair / replacement</td>
<td>• Machine or Loader</td>
<td>• Inaccurate set-up</td>
</tr>
<tr>
<td>• Re-Calibration</td>
<td>• Tools</td>
<td>• Measurement device calibration</td>
</tr>
<tr>
<td>• Awaiting job / materials / tools</td>
<td>• Materials (quality / availability)</td>
<td>• Tool failure / wear</td>
</tr>
<tr>
<td>• Awaiting operator</td>
<td>• Downtime (un-planned)</td>
<td>• Machine failure</td>
</tr>
<tr>
<td>• Operator shut-down</td>
<td>• Output Quality issues</td>
<td>• Materials failure</td>
</tr>
<tr>
<td>• Services failure</td>
<td>• Re-work</td>
<td>• Design failure</td>
</tr>
<tr>
<td>• Materials failure</td>
<td>• Inaccurate standards (e.g. parts per hour)</td>
<td></td>
</tr>
<tr>
<td>• Quality issues</td>
<td>• Downstream delays / bottlenecks</td>
<td></td>
</tr>
<tr>
<td>• Accident / Health &amp; Safety</td>
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| Planned downtime                                  |                                                |                                            |
| • Maintenance                                     |                                                |                                            |
| • Clean down                                      |                                                |                                            |
| • Job change / set-up                             |                                                |                                            |
| • Tool change                                     |                                                |                                            |
| • Tool replacement (wear)                         |                                                |                                            |
| • Inspection / calibration                        |                                                |                                            |
| • Breaks                                          |                                                |                                            |
| • Shift change                                    |                                                |                                            |
| • Machine not needed                              |                                                |                                            |

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Factory Analytics

Database / Warehouse / Lake

- Data base (e.g. SQL + XML)
- Direct to PLC (IP + ASCII + ANSI + ZIGBEE + (MQTT / AQMP / STOMP) + Proprietary)
- Sensors
- Device + Sensors

OCF Analytics Cloud
Future
Going forwards

• Broader and deeper
• RoI driving more investment
• ‘Trickle-down’
• AI & automation
• Consumption and Appliances
• Security & Risk
• Regulation
Going forwards

- Broader and deeper
- RoI driving more
- ‘Trickle-down’

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Thank you!

cbrereton@ocf-data.co.uk
+44 7850 189938