



Institute
and Faculty
of Actuaries

Application of machine learning in motor insurance pricing

James Rakow – Partner, Deloitte (email: jrakow@deloitte.co.uk)

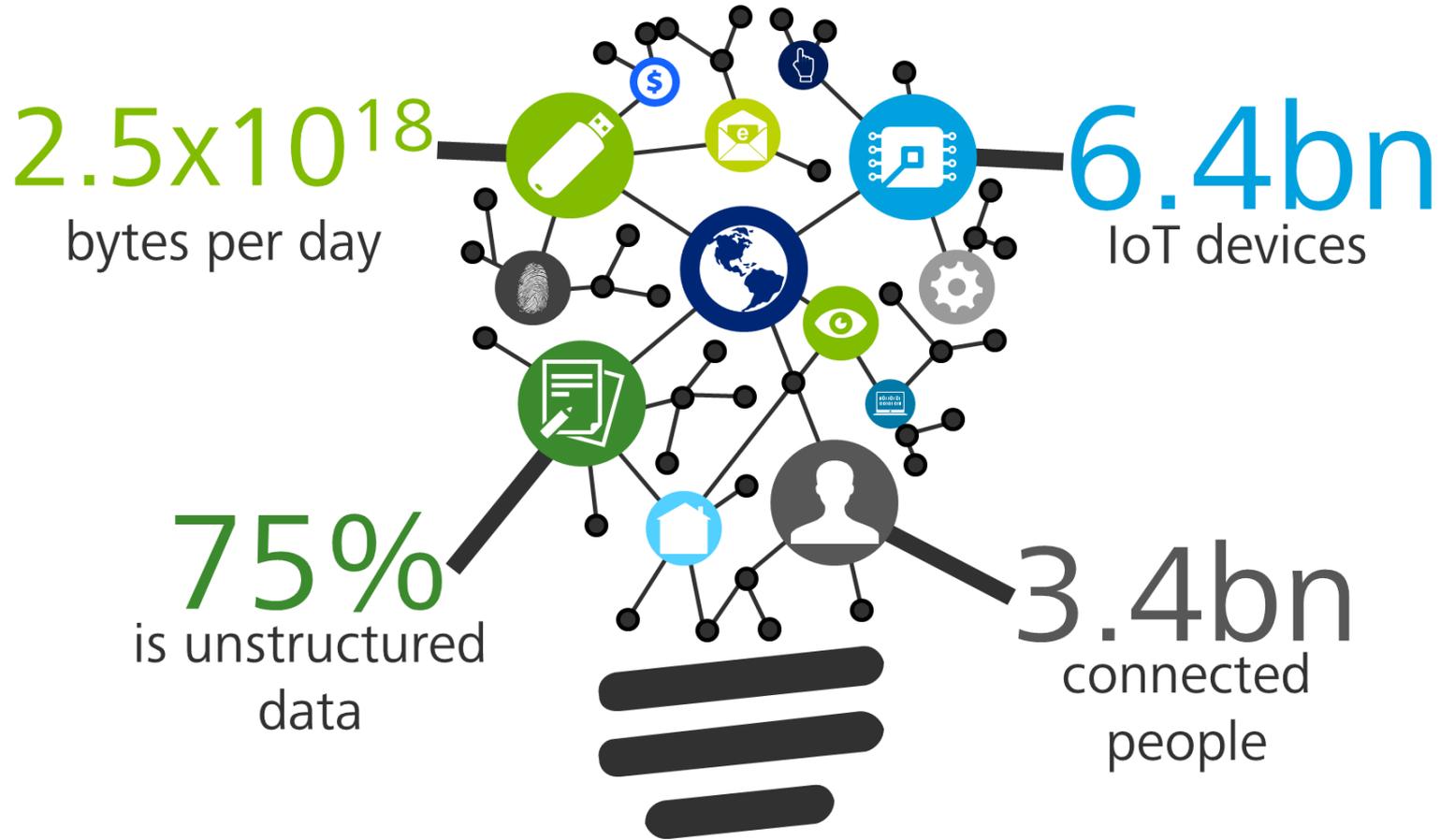
Sulabh Soral – Director, Deloitte (email: ssoral@deloitte.co.uk)

Agenda

- **Machine Learning – Why now?**
- **Some examples**
- **How does it impact motor insurance pricing?**
- **How does it impact our day jobs?**

Machine Learning – Why now?

Information rich ecosystem

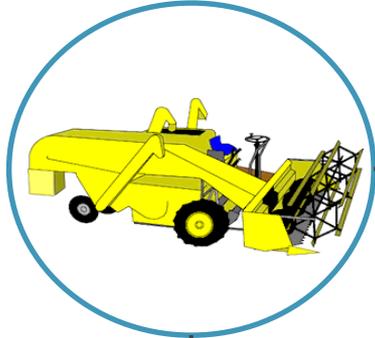


More information helps!

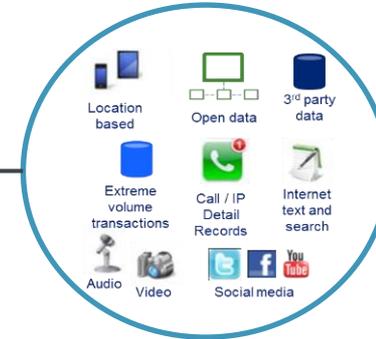


Does more information mean ready insights?

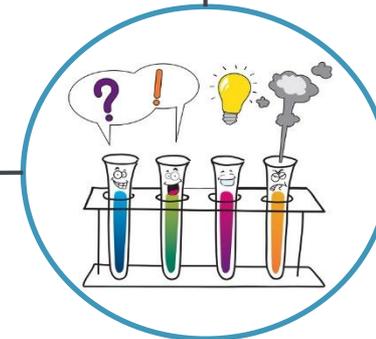
Ever increasing massive data lakes need to be harvested



Many different sources and formats to transform

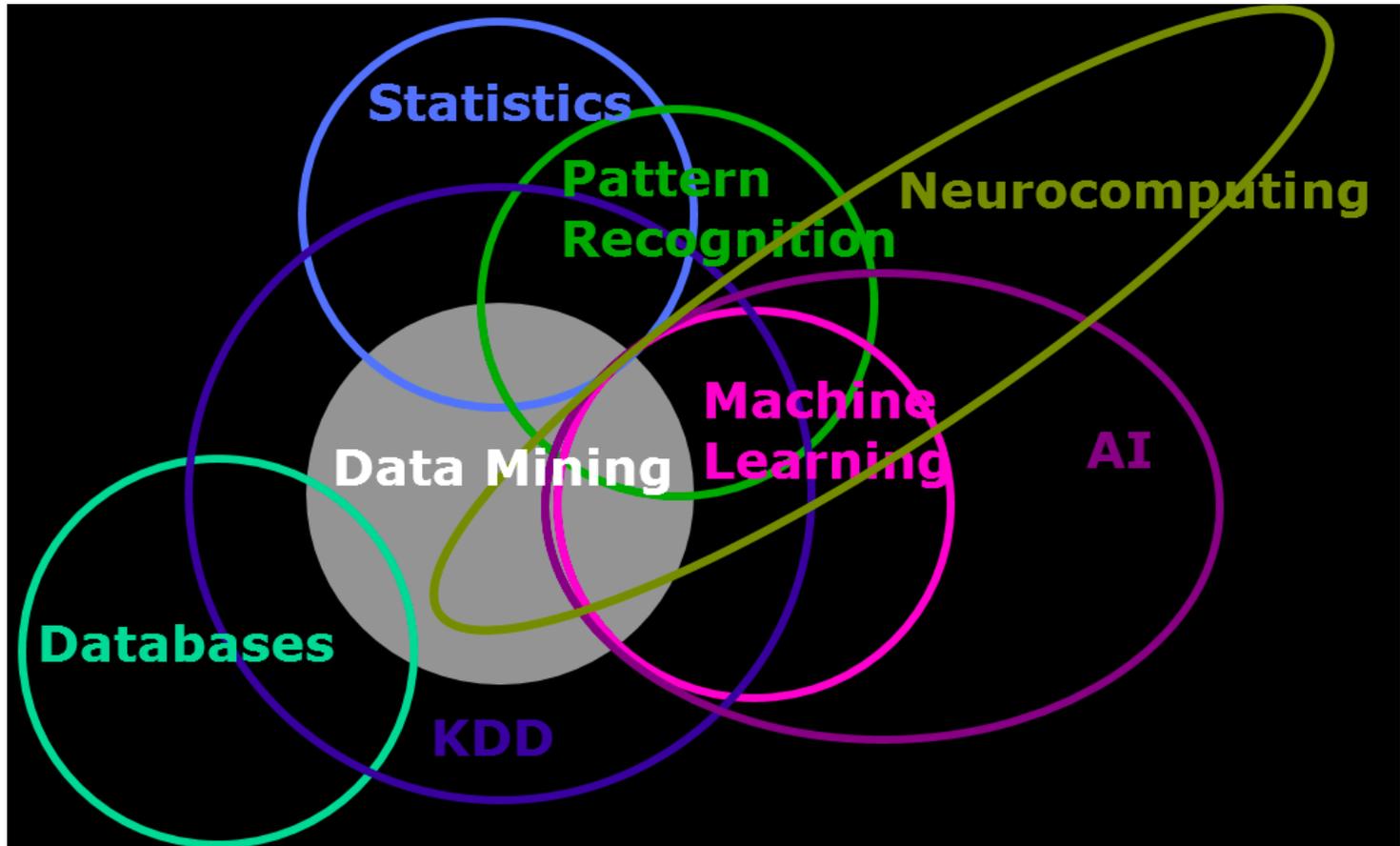


High noise so need to look deeper



Many more combinations possible

Introducing machine learning



Source – SAS Institute

Introducing machine learning

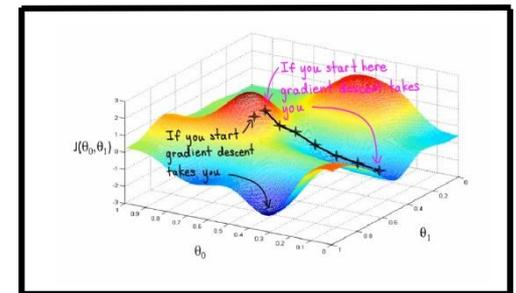
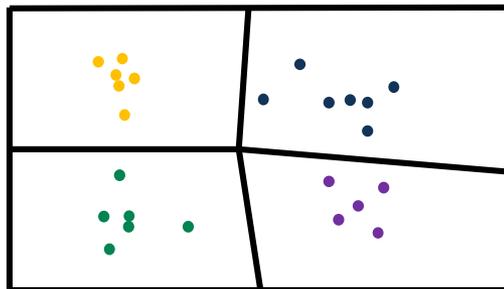
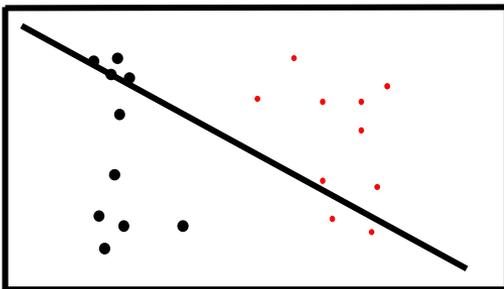
Machine Learning vs. Statistical Modelling

- Emphasis on learning in machine learning
- Emphasis on inference in statistical models
- Process to build models is different because –
 - Come from different backgrounds (Subjects and history)
 - Many more a priori assumptions/expectations in statistical modelling
 - Focus on generalisation vs. fitting to distribution
 - Big data vs. limited sets
 - Machine learning vs. Hypothesis/human effort
 - Techniques used
 - In statistical modelling we start with an understanding of correlations and distribution and then optimise a predictor but in machine learning we start with no such understanding

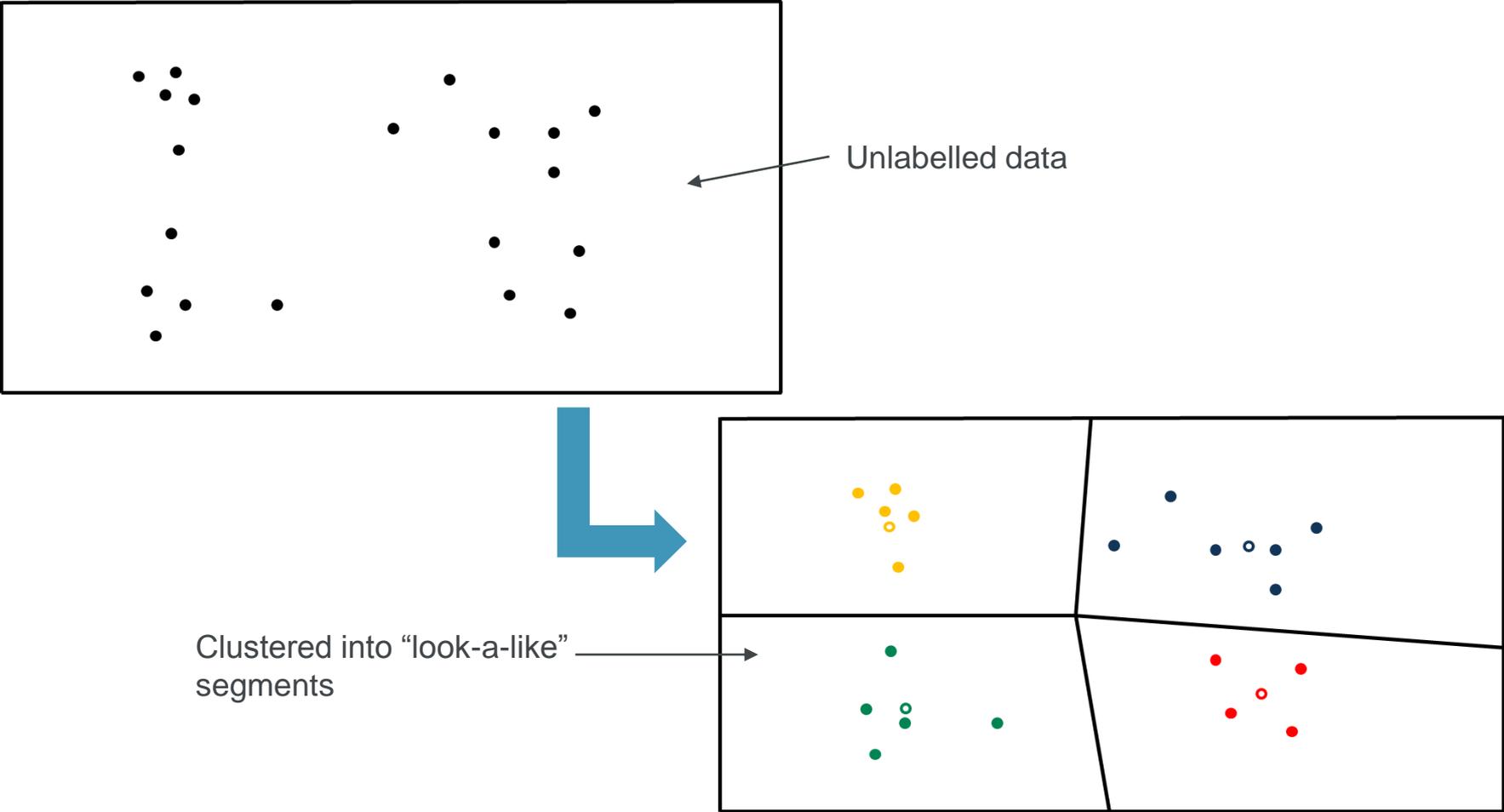
Introducing machine learning

Types of ML

- Supervised - Is used with labelled data (All inputs are paired with outputs in a training set)
- Unsupervised - Is used with un-labelled data (Inputs not paired with any preconceived output)
- Reinforced - Learning the process to reach a desired outcome (In a way a mix of supervised and unsupervised)
- Others



Unsupervised Learning - Clustering

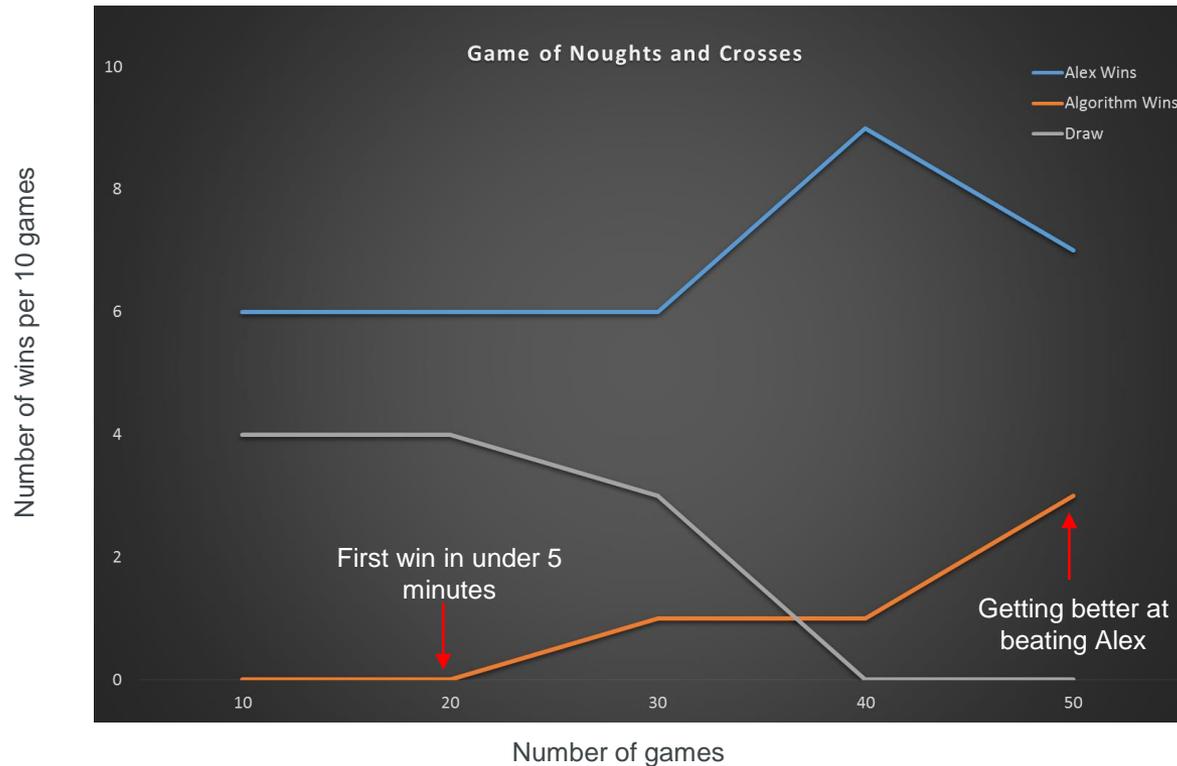


A Game of Noughts (and crosses)

An example of reinforced learning



VS.



Some Examples

Machine learning toolkit

CORE TECHNOLOGIES

ARTIFICIAL
INTELLIGENCE



DEEP LEARNING



MACHINE
LEARNING



PREDICTIVE APIS



IMAGE
RECOGNITION



SPEECH
RECOGNITION



FINANCE



EDUCATION



AUTOMOTIVE



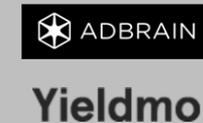
RETAIL



OIL AND GAS



ADTECH



INNOVATIVE INDUSTRIES

SUPPORTING TECHNOLOGIES

HARDWARE



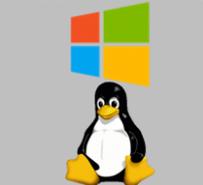
DATA COLLECTION



SOFTWARE



OPERATING SYSTEM



DATABASE



CLOUD



Some examples of data based innovations supported by machine learning

Social data



Sensors and images



Auditory

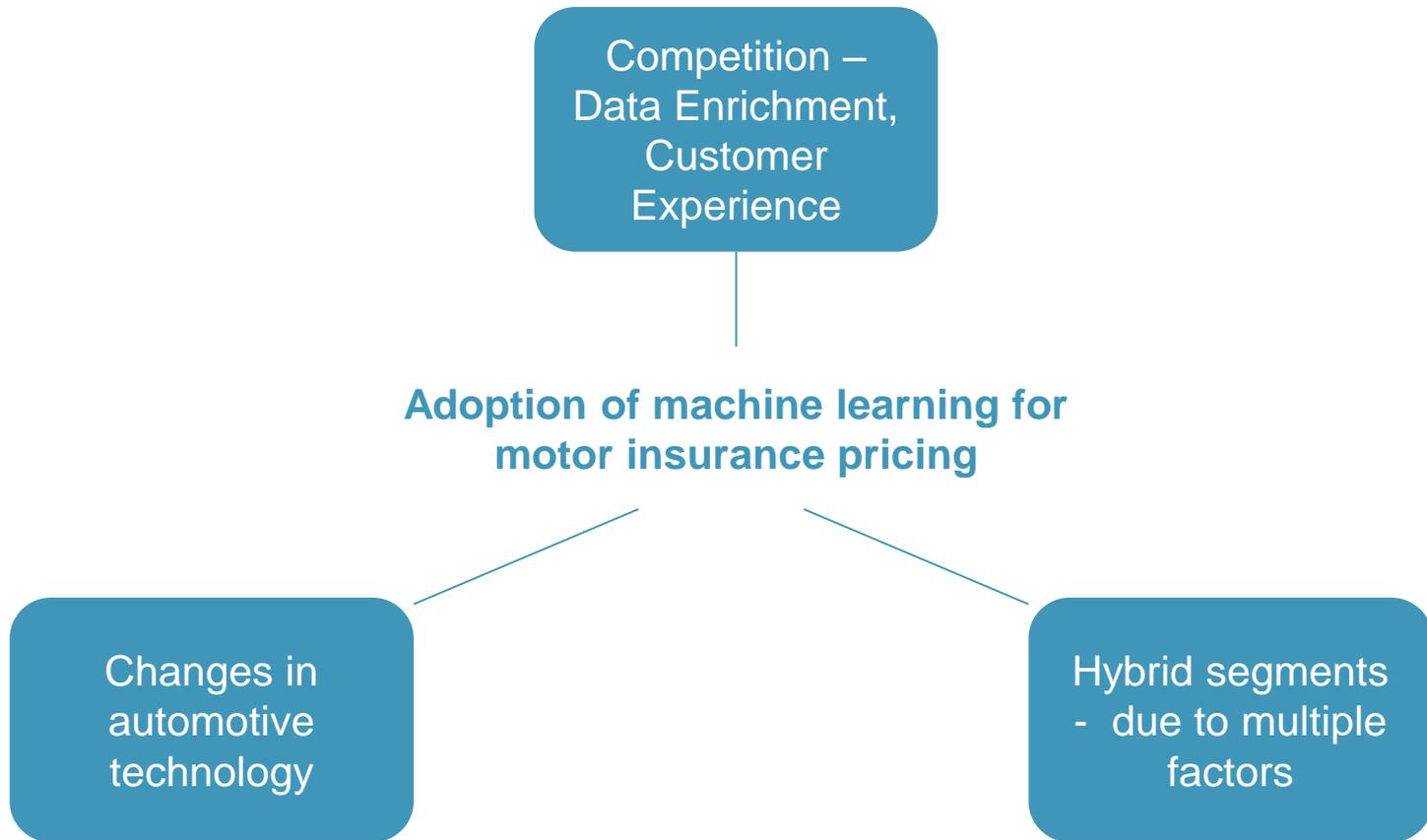


Open



Impact on motor insurance pricing

Motor insurers will have to embrace machine learning



Notes from our ML experiences in motor pricing

Data Enrichment

- New sources of data – Machine learning used to transform data and find new patterns (Open, third party, others)
- Better lift curves

Better point of quote experience

- Reduction in number of policy holder inputs (“traditional data”) required – Machine learning used to find patterns in alternative data sources
- Without reduction in predictive accuracy

Better model building

- Relaxation in model assumptions as compared to traditional models
- More predictive accuracy
- Easy to integrate alternative data sources with Machine Learning in pricing models – Traditional tools are limited
- Interactions machine led not hypothesis led
- Non restrictive processes – can use multiple different models at pace

Notes from our ML experiences in motor pricing (continued)

Quicker model building and testing

- Faster turnaround time – Minimum human intervention required as compared to traditional tools: choosing variables, transforming/smoothing, setting interactions etc.
- Faster in testing too

Newer insights

- Cutting the data in a new way led to newer insights – needs segments that can develop new products

Other experiences from machine learning (apart from pricing)

- Commercial and operational excellence – Claims and Fraud
- Better customer relationships – Recommender systems
- New products and markets – Pay per mile

Things to consider

Prediction accuracy vs. inference

- Most machine learning algorithms are complex and blackbox
- Hard to explain – Note regulatory requirements

Technology

- High powered computing - costs
- However a lot of machine learning infrastructure is open

Talent

- Expertise in data science
- Programming

Pricing in motor insurance will undergo a process enhancement and as a first step machine learning can be used for data enrichment and open machine learning platforms can speed up building/testing GLMs - The way forward is a mix between the 2 approaches

How does it impact our day jobs?

Training

What do actuaries learn about Analytics?

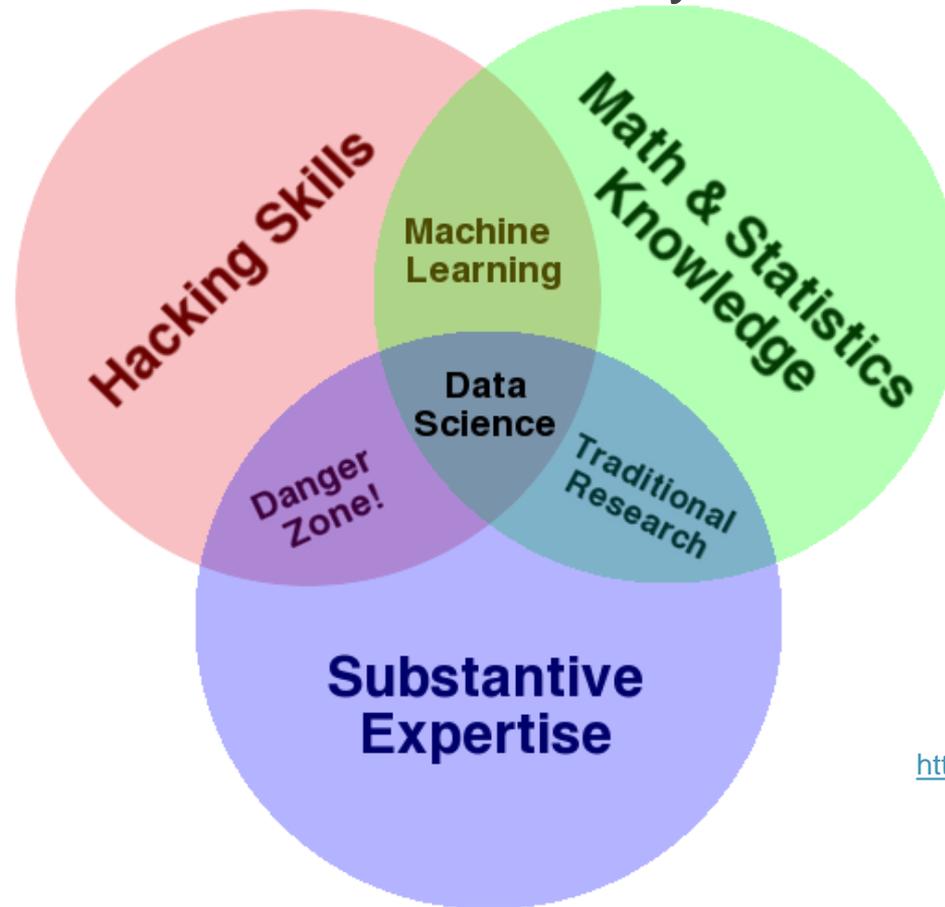


Image borrowed from Drew Conway's blog
<http://www.dataists.com/2010/09/the-data-science-venn-diagram>

Training

- How much actuarial work is – or should be – here?

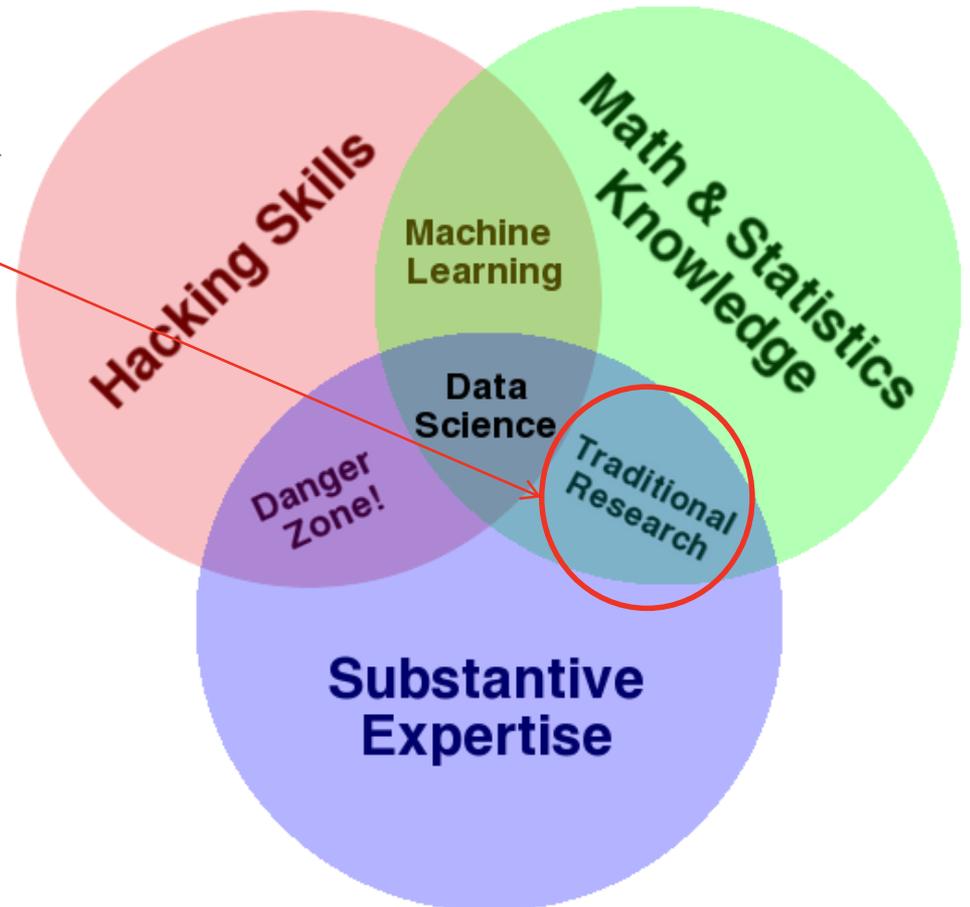


Image borrowed from Drew Conway's blog
<http://www.dataists.com/2010/09/the-data-science-venn-diagram>

Training

- As opposed to here?

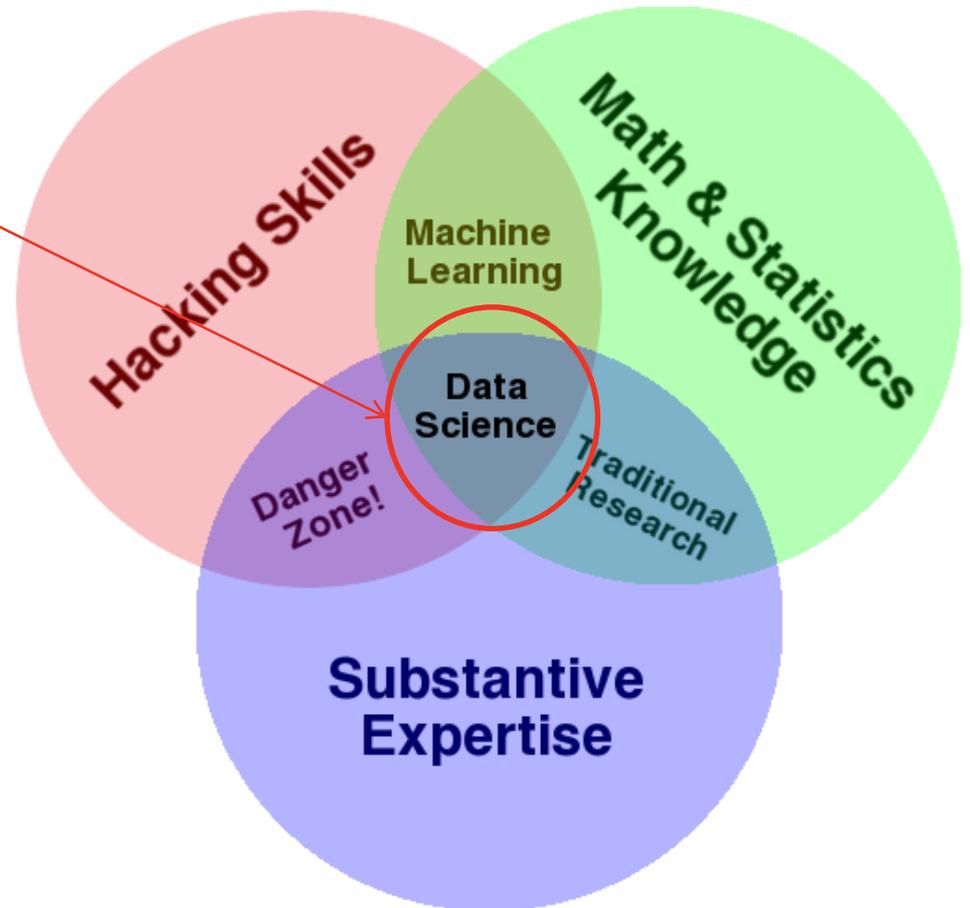


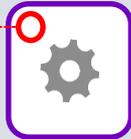
Image borrowed from Drew Conway's blog
<http://www.dataists.com/2010/09/the-data-science-venn-diagram>

Our Future - 'Purple people'

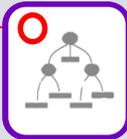


Technical skills

Data wrangling skills
Ability to utilise a wide range of software to manipulate data and facilitate data discoveries



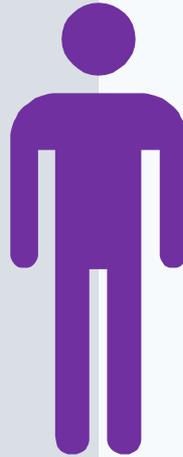
Model building and data science
Ability to identify and apply the optimal modelling techniques



Testing and validation
Defining, developing and implementing quality assurance practices and procedures for technical solutions and validating hypotheses



Data visualisation
Ability to simplify the communication of complex information through specialised interactive software



Business skills

Macro-perspective
Understanding business strategy, current business issues and priorities and current Insurance industry trends



Insurance and pensions knowledge
Understanding of key Insurance and pension scheme functions such as underwriting, claims and actuarial



Benefits quantification
Articulation of how insight and granular predictions can be implemented and value quantified



Soft skills
Skills necessary to convince experts to adopt advanced Analytics into their decision making process and communicate results



“Insurance is one of the most data intensive industries. Historically actuaries and underwriters have always dealt with large data sets and have used these to make decisions. But in spite of this, insurance analytics rarely features on the business school curriculum. It is time that business schools recognise that there needs to be specialised courses on insurance analytics. A lack of skilled analysts in this sector is preventing the insurance industry from advancing.”

**Insurance analytics –
The missing link:
Financial Times, October
2014**

Questions?