



# Sustainable Education for Professional Statisticians

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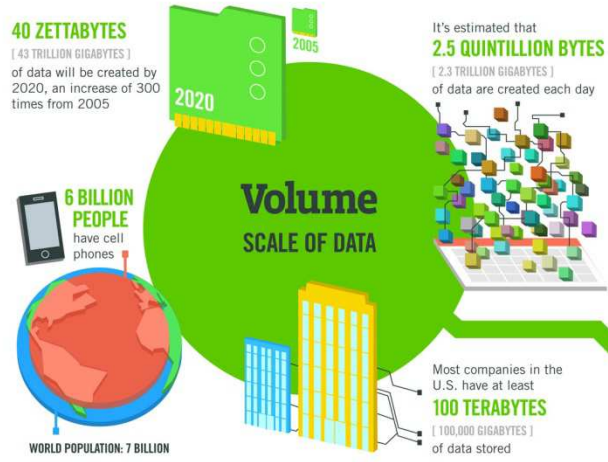
Escola Nacional de Ciências Estatísticas  
(ENCE/IBGE)

# Summary

- The profession & the challenges.
- Defining the profession – accreditation.
- Requirements for achieving and maintaining accreditation.
- Some sustainable ideas to ‘keep fit’.

# The Profession & The Challenges

**Big data** and the associated revolution in data availability, accessibility, speed of production and pressure to ‘do something’ with the available data.



# The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015 **4.4 MILLION IT JOBS** will be created globally to support big data, with 1.9 million in the United States



As of 2011, the global size of data in healthcare was estimated to be **150 EXABYTES** [ 161 BILLION GIGABYTES ]



**30 BILLION PIECES OF CONTENT** are shared on Facebook every month



By 2014, it's anticipated there will be **420 MILLION WEARABLE, WIRELESS HEALTH MONITORS**

**4 BILLION+ HOURS OF VIDEO** are watched on YouTube each month



**400 MILLION TWEETS** are sent per day by about 200 million monthly active users

## Variety DIFFERENT FORMS OF DATA

The New York Stock Exchange captures **1 TB OF TRADE INFORMATION** during each trading session



Modern cars have close to **100 SENSORS** that monitor items such as fuel level and tire pressure

## Velocity ANALYSIS OF STREAMING DATA

By 2016, it is projected there will be **18.9 BILLION NETWORK CONNECTIONS** - almost 2.5 connections per person on earth



**1 IN 3 BUSINESS LEADERS** don't trust the information they use to make decisions



Poor data quality costs the US economy around **\$3.1 TRILLION A YEAR**



**27% OF RESPONDENTS**

## Veracity UNCERTAINTY OF DATA

in one survey were unsure of how much of their data was inaccurate

Sources: McKinsey Global Institute, Twitter, Cisco, Gartner, EMC, SAS, IBM, MEPEEC, QAS



Source:  
<http://www-01.ibm.com/software/data/bigdata/>

# The Profession & The Challenges

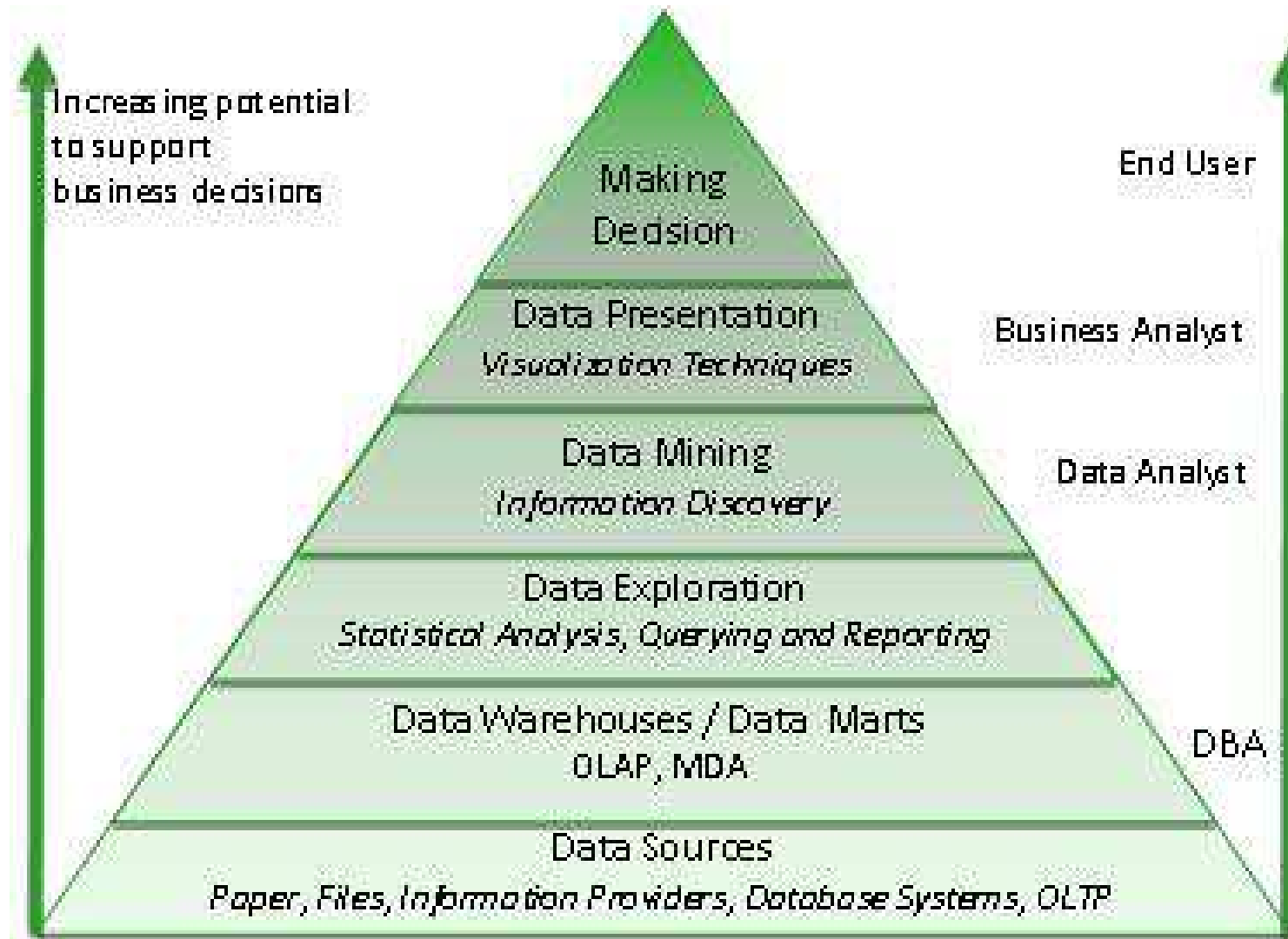
Modern approaches where the ‘art and science’ of data analysis, modeling and inference are being built up into software:

- Machine learning;
- **Artificial intelligence;**
- **Data mining;**
- Etc.



Source:

<http://reason.cs.uiuc.edu/jaesik/research/probabilistic-artificial-intelligence-lab/>

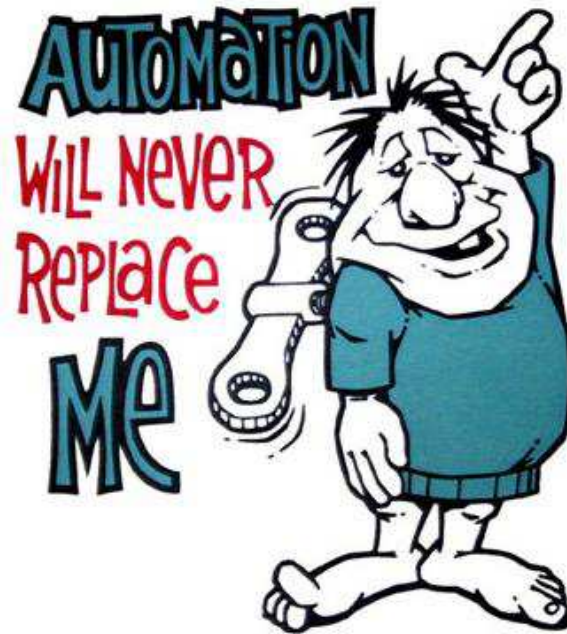


Source:

[http://www.ppdm.org/wiki/index.php/Data\\_Mining](http://www.ppdm.org/wiki/index.php/Data_Mining)

# The Profession & The Challenges

Rapidly evolving software, which aims to be less dependent on the skills of the users;



Source:

<http://www.youngandprosperous.com/2010/09/fe-ar-of-automation/>



# The Profession & The Challenges

- **Increasing costs** of traditional in-person education.
- **Fast evolution** of methodology and technology, demanding time and effort to keep up with the developments.
- Ever **wider areas of application** of Statistics with their own dialects and promotion of ‘DIY’ by users:
  - Often lacking broader statistical education,
  - but using complex and specialized statistical tools (models , methods and software) relevant to their fields.

# 'Professional Statistician'

- Getting more and more difficult to define.
- Challenges from emerging 'areas' / trends:
- Implications for job naming:
  - Data Scientist;
  - Data Analytics Consultant;
  - Digital Data Analyst;
  - Research / Marketing Web Analyst;
  - Research Statistician and Data Manager;
  - Etc.

### Data Scientist

London, GB-LND | Competitive Salary

Guardian News & Media Ltd. is one of the most successful and innovative media organisations in the world, renowned for leading edge journalism, product and commercial development, and famous for nurturing talented individuals. The Guardian is committed to providing a world-class environment for its employees.

All jobs from: [GUARDIAN NEWS AND MEDIA](#)



### Data Analysts

1 day left

Northern Quarter, Manchester City Centre | £18K - £35K dependent on experience

Lots of Data Nerds Analysed! Morris Hargreaves McIntyre, award-winning international consultancy in the cultural sector, seeks data analysts to join its talented team. Rapid expansion and a growing client base means we have a lot of data to analyse.

Employer: MORRIS HARGREAVES MCINTYRE

★ Add to Shortlist

### Lead Data Scientist- Media Analytics

London | £36000 - £39000 per annum

One of the market leaders in media analytics is recruiting a lead data scientist to help them bring analytics to life for their clients and to eventually become a data guru for the agency.

### Insight Analyst

London | £26,000 - £32,000 per annum + Excellent benefits

Are you a highly skilled Data Analyst with experience in delivering insights and analytical solutions? Do you use analytics to influence and improve marketing strategies?

### Data Mining Manager - Weymouth

Weymouth, Dorset | £35,373 PA

Counter Fraud Skills are currently seeking a Data Mining Manager to work in a permanent role based in Weymouth.

Employer: COUNTER FRAUD SKILLS

★ Add to Shortlist

### Statistical/ Analytical Modeler

Dublin | Negotiable



Statistical Modeler - Based in central Dublin This position exists to provide consulting/advisory services and to conduct statistical analysis and build predictive models for a variety of performance outcomes such as risk, fraud, and collections for one of our clients.

All jobs from: [LEXIS NEXIS](#)

★ Add to Shortlist

# Research/ Marketing Web Analyst

Working for this international client to **provide data, reports and analysis** to inform the strategic decision making.

The role will focus on the **provision and analysis of marketing, web and usage data and analytics.**

The Guardian

<http://jobs.theguardian.com/st/jobs-analytics.html>

Captured on 6/Jul/2014.

# Job searches on Google

Search terms	Hits (Thousands)
job statistician	4.220
statistics jobs	548.000
jobs in statistics	746.000
analytics jobs	74.800
job analytics	187.000
jobs in analytics	171.000
jobs data mining	136.000
jobs in data science	479.000
jobs big data	837.000

Searched on 7/7/14.

# Professional Statisticians

- **Accreditation** is offered in some countries.
- US and UK adopt **voluntary** accreditation schemes.
- Brazil adopts **compulsory** accreditation.
- Why look at accreditation: for a definition of what is required to become a ‘Professional’ (US) or ‘Chartered’ (UK) Statistician.

# PStat<sup>®</sup> Scheme in the US

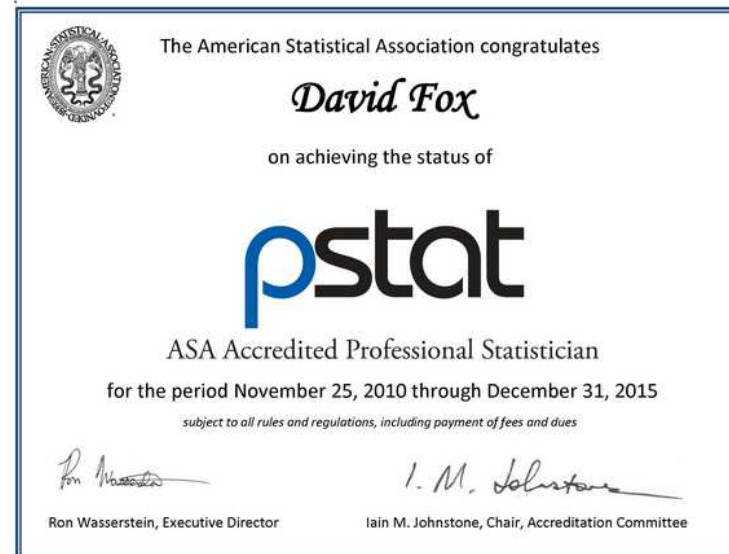
- **PStat<sup>®</sup> scheme** requires **peer recognition** that applicants have:
  - **Statistical training and knowledge** (MSc. or PhD.);
  - **Experience** in applying the expertise competently (> 5 years since graduating);
  - Maintenance of appropriate **professional development**;
  - Agreement to abide by professional **code of ethics**;
  - **Ability to communicate effectively**.

Source:

[https://www.amstat.org/accreditation/pdfs/Guidelines\\_for\\_ASAVoluntary\\_Professional\\_Accreditation.pdf](https://www.amstat.org/accreditation/pdfs/Guidelines_for_ASAVoluntary_Professional_Accreditation.pdf)

# PStat<sup>®</sup> Educational Requirements

- Advanced degree in Statistics or related quantitative field, with sufficient concentration of Statistics.
- Field may include mathematical or applied Statistics, or major application areas, such as Biostatistics.





# Professional Statistical Experience

- Undertaking statistical analysis of data and reporting on the results;
- Having responsibility for the interpretation and presentation of statistical information;
- Leading projects with a substantial amount of statistical analysis or modelling;
- Teaching statistics based on practice;
- Work/consulting/collaboration and any resulting teaching of statistics for a field of application;

# Professional Statistical Experience

- Working as a statistical consultant;
- Carrying out and implementing research to develop new methods to solve significant applied statistical problems;
- Taking responsibility for the design and analysis of statistically based surveys (or experiments);
- Managing a statistics section with work in one or more of the above areas;
- Generally recognized as having made a substantial contribution to the sound practice of statistics.

# Professional Competence

Evidence that work as an applied statistician is of high quality, by demonstrating:

- Substantial positive impact on decision making;
- Appropriately applied methods and techniques;
- Adequate discussion of limitations of the data, methods, techniques;
- Proper attention to accuracy, reliability, relevance, reproducibility and transparency;
- Recognition of applied work by peers.

# Professional Development

- PStat<sup>®</sup> accreditation requires **maintaining competence** in the chosen area of statistical practice.
  - Must complete at least **60 hours** of professional development **each year**.
  - Must keep and submit records of professional development activities to apply for renewal of accreditation (**every 5 years**).
- ➔ Accreditation is NOT permanent.



# Professional Development

- What counts towards professional development:
  - Work-based learning;
  - Professional activity;
  - Formal / educational activities;
  - Self-directed learning;
  - Other (??).
- Professionals must have activities in at least three of the categories above.

Some sustainable ideas to 'keep fit'.



# Read, listen, reach out

- Lots going on ‘around’ Statistics.
- Read frequently.
- Read outside of your own area of expertise.
- Review work of others (refereeing, etc.).
- Attend seminars / talks / conferences in other areas, not only in ‘Statistics’.
- Join ‘study groups’ or ‘learning communities’.



# Present and discuss your work

- Make sure that you present and discuss your work with peers and with ‘users’.
- Good presentations always raise good questions and discussion, which can lead to improvement and learning.
- They also create opportunities for legitimate challenges to be identified.





# Write-up your work

- Make sure that you write-up your work.
- Writing-up helps focus on the important ideas, concepts, methods and results.
- It is also essential to get it more thoroughly reviewed.
- Another good way of creating opportunities for legitimate challenges to be identified.
- Organizations may help with policies on writing and reviewing.



# Develop and teach courses

- Teaching a course is a fantastic opportunity to learn / consolidate knowledge.
- It helps you to revisit the topics of the course, broaden your own knowledge.
- It also raises opportunities for questions, which you may use to learn more.
- Make sure your teaching is assessed and take notice of the outcome and comments.
- Organizations may assist with policies to encourage continued professional education.

## Supervise, mentor, junior colleagues

- Supervising or mentoring the work of others also provides opportunities for learning.
- When possible, engage formally in such activities.
- Example: joint appointments.
- Mentoring is also great to keep abreast of new trends and perceptions prevailing with the younger generations.



# Attend conferences

- Plan for and invest in attending professional conferences.
- They enable opportunities for concentrated exposure to what's going on and novelties.
- Use them to plan your forthcoming personal development activities, by defining priority areas or topics.
- Exploit their networking opportunities to engage in the other learning activities.

## Join a professional society

- Professional & academic societies facilitate all of the above mentioned activities.
- Yet not all professionals join or take part.
- The cost of joining societies is modest, for the services they provide.
- They offer a convenient and focused approach to networking and to be involved.
- They also provide many opportunities for continued education.

# Take courses

- Formal courses are a good source of learning.
- They have the benefit of structure and a natural learning community.
- They may lack the precise focus you need.
- But they will help you focus on learning for a well defined period of time.
- They also help with record keeping.

# Distance learning



- A powerful new approach for learning (and teaching) Statistics (and many other things).
- Challenge: Statisticians must be more pro-active in the learning process.
- Opportunity: Distance learning makes it possible to learn from the best.
- It enables continued education both at home or at the workplace.

# Statistical software



- Professional statisticians must be proficient in at least one major statistical software.
- R seems the current best possible choice.
- Because it is free and open source, in theory you can use it ‘wherever you are’, ‘forever’.
- What if you don’t know R yet?
- Here is a good opportunity to start those plans and actions toward learning something.



# Consult & collaborate

- Consulting and collaborating is another good approach to learn.
- You will face new problems.
- You will often need to learn something new to be able to tackle the problems.
- Even if you can solve a problem with the tools you know, you will have learned something about their use in each situation.

## Save and invest in ‘keeping fit’

- Each professional should take control of their continued professional education.
- Saving and investing in your own continued development does not depend on others.
- Employers may help, but you should not rely solely on others for this.
- Programme your savings, keep to the plan.
- Then enjoy the ‘freedom’ to invest in what you find most profitable or effective.

# Societies and what they can do

- Promote the idea that continued professional development is essential.
- Offer all the current activities and innovate to keep up with times.
- Facilitate engagement of professionals from the earliest stages of their education / career.
- Provide focal point for continued professional development.



# Employers and what they can do

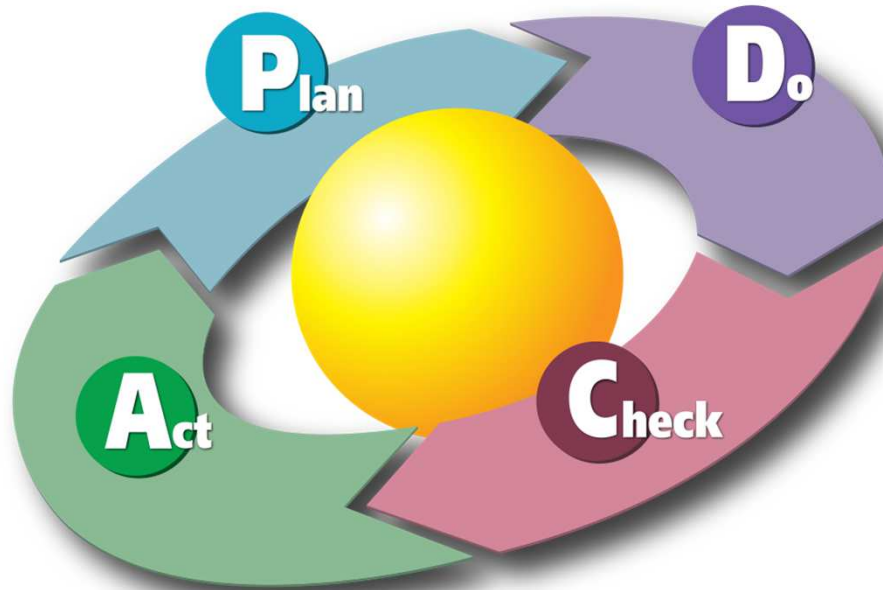
- Promote the idea that continued professional development is essential.
- Encourage / support activities that lead to continued professional development.
- Invest in the promotion of CPD for their staff.
- Engage with their staff in planning and implementing their CPD.

# Teachers and what they can do

- Lead by example.
- Formally discuss ideas of how one can and should take charge of their own CPD.
- Demonstrate the importance of `keeping fit` for a profession that depends heavily on technology and methodology.
- Promote the attitude and develop the skills needed for independent learning.

# Some tools which can be used

- PDPA cycle
  - Plan, develop, check/assess, adjust/review.



- Apply to personal development strategy.



Period	Activity								
	Read, listen, reach out	Present and discuss your work	Write-up your work	Develop and teach courses	Supervise, mentor colleagues	Attend conferences	Join a professional or academic society	Take courses	Consult & collaborate
2014	Jan			Analysis of complex survey data	PhD Thesis A. Gutierrez		ISI, IASS, ABE, ASA, RSS,		
	Feb								
	Mar	Methodology Dept. Seminar	Survey on Cardiovascular Risk in Adolescents	Introd. Stats for Journalists					Survey on Cardiovascular Risk in Adolescents
	Apr		Household Survey of Drug Consumption						Household Survey of Drug Consumption
	May	Seminar São Carlos							
	Jun		Survey of lan houses						Survey of lan houses
	Jul				BSc Mon. H. Souza	ICOTS9, SINAPE			
	Aug			Data Editing & Imputation	MSc diss. R. Caumo	JSM			
	Sep			Analysis of complex survey data					
	Oct								
	Nov			Designing Surveys for Policy Evaluation		ISI Regional Conf. Malaysia			
	Dec								

# Above All

- Develop an attitude to learn continuously.
- After all, who can say that what he/she learned at University will suffice for doing Statistics professionally after 20 years?

Source: my ICOTS7 presentation in Salvador.



Let me finish by inviting you to the

60<sup>th</sup> ISI World Statistics Congress  
ISI2015

26-31 July – Rio de Janeiro

[www.isi2015.org](http://www.isi2015.org)