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# Data Science, Machine Learning and Big Data

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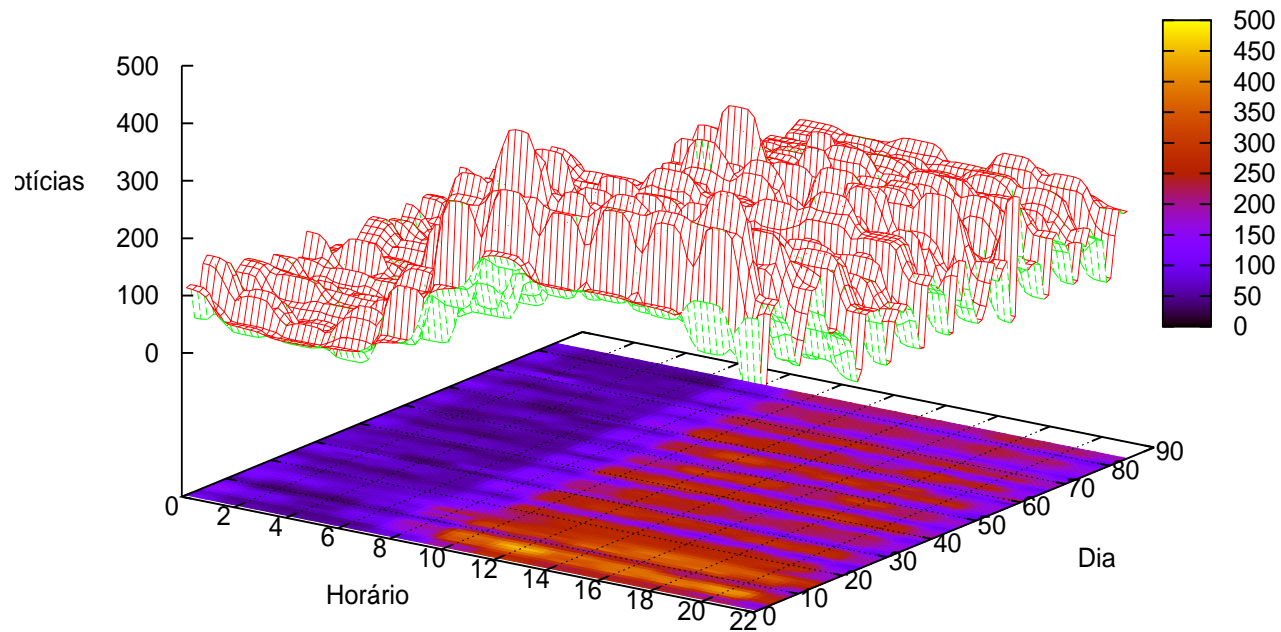
# Problema



<http://investingcaffeine.com/2010/01/07/tmi-the-age-of-information-overload/>

# Alguns dados...

Relação Horário x Dia x Quantidade de Notícias Produzidas



Quantidade de notícias publicadas na Web por apenas seis veículos brasileiros de notícias ( $D_0 = 17/07/2007$ )

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## Dados mais atuais

- A380: Heathrow → JFK: 640 TBs de log
- Twitter: 12+ TBs of tweet every day
- Facebook: 25+ TBs of log data every day
- Sistemas baseados em RFID
- Smartphones com GPS, acelerómetro, ...

*<http://www.ibmbigdatahub.com/>*

*Mitchell. Mining our reality. Science. 2009*

# De onde vem os dados?



Mobile Sensors



FACEBOOK  
GROWS BY  
250 MILLION  
PHOTOS / DAY

Social Media



Video  
Surveillance

Video Rendering



READING METERS  
EVERY 15 MINS.  
IS 3,000X MORE  
DATA INTENSIVE



Smart Grids

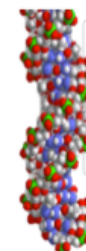


Geophysical  
Exploration

Medical Imaging



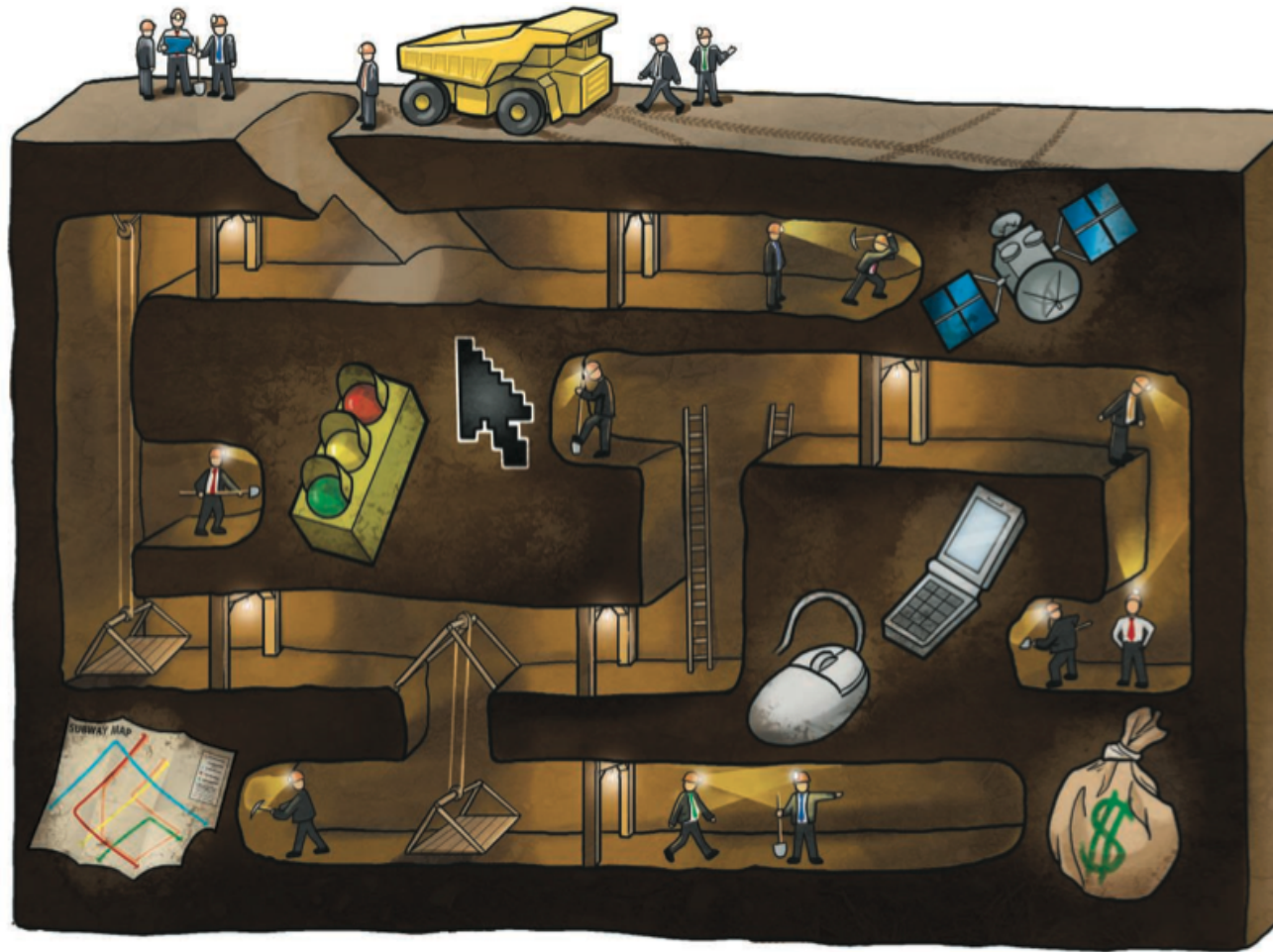
Gene Sequencing



COST TO SEQUENCE  
ONE GENOME  
HAS FALLEN FROM  
\$100M IN 2001  
TO \$10K IN 2011

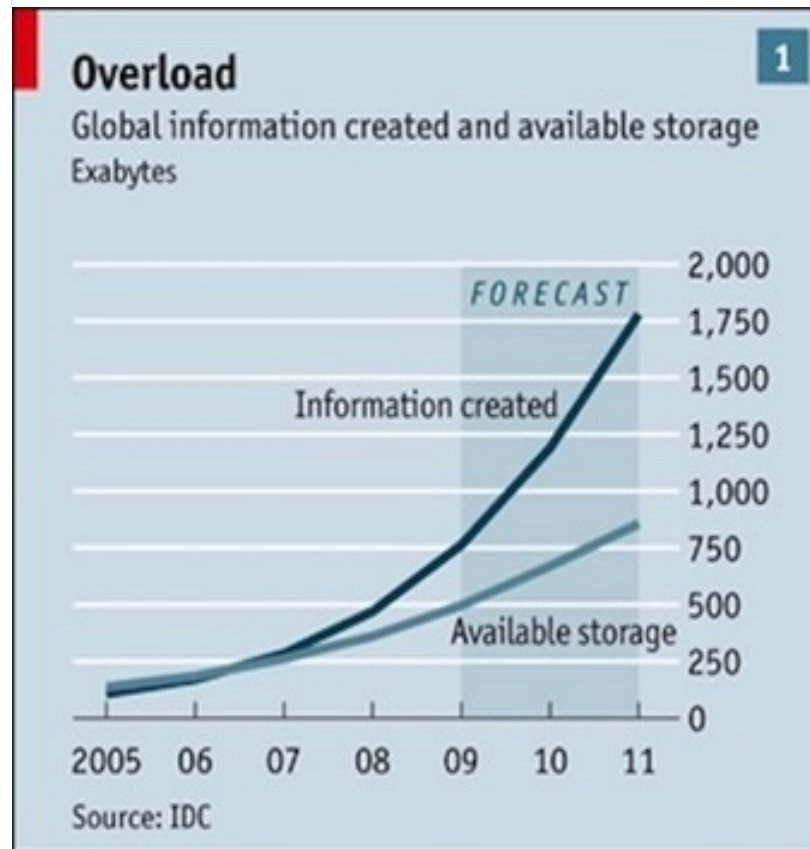
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# Mining our reality



*Mitchell. Mining our reality. Science. 2009*

# Big Data



*“We collect an astonishing amount of digital information... ..we’ve long since surpassed our ability to store and process it all. Big data is here, and it’s causing big problems...”*<sup>[1]</sup>

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# Big Data é um conceito relativo

- O que é **grande hoje...**
- Pode não ser **grande amanhã...**

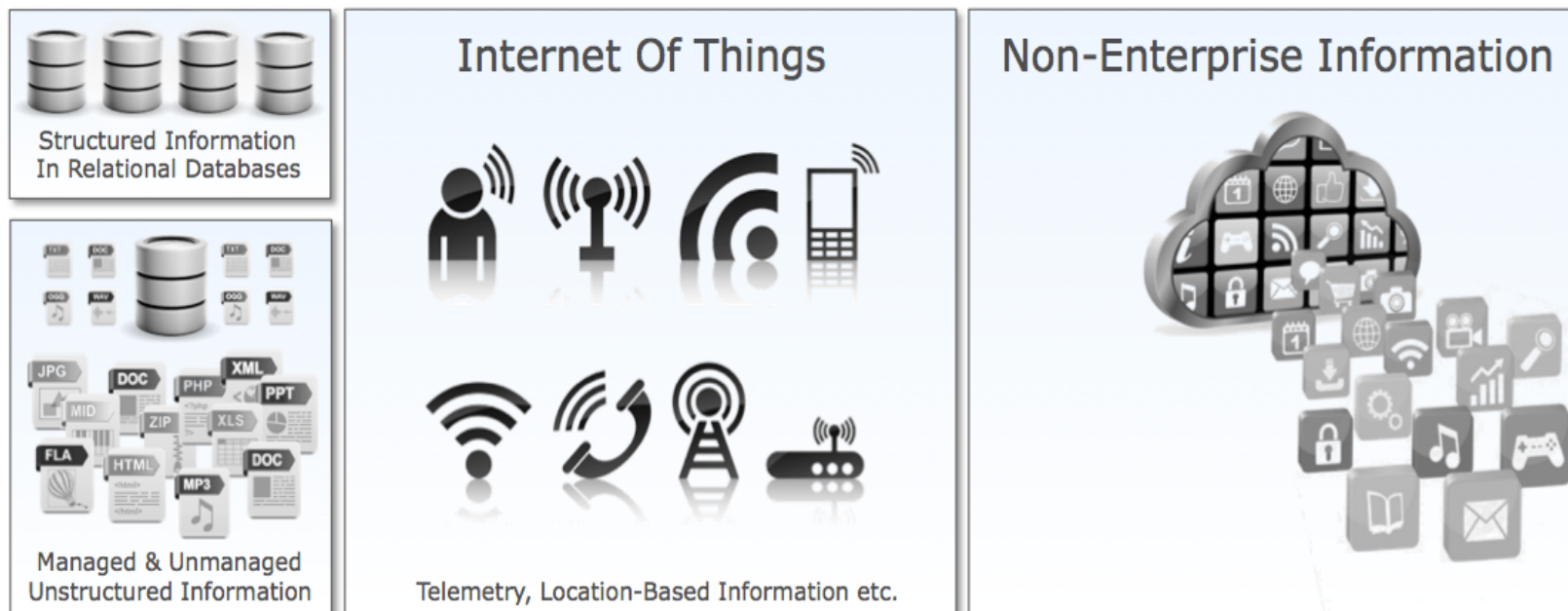


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## Big Data refers to...

- All data that comes at high **Volume**
- All data that comes at high **Velocity**
- All data that comes from a **Variety of Sources**  
(structured + unstructured data)

# Variety of sources



The Digital Universe Is Growing By 7,600 PB / Day

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## Por que manipular este tipo de dado?

- Identificar comportamento anômalo (i.e., fraudes, falhas)
- Sumarizar tendências de publicações de artigos e patentes sobre um determinado tema.
- Sumarizar e filtrar notícias relevantes.

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- Sumarizar a opinião expressa na Web sobre a sua empresa.
  - Identificar padrões de navegação em sites.
  - Identificar conteúdo impróprio em sites.
  - Recomendação de livros, filmes, restaurantes e empregos.

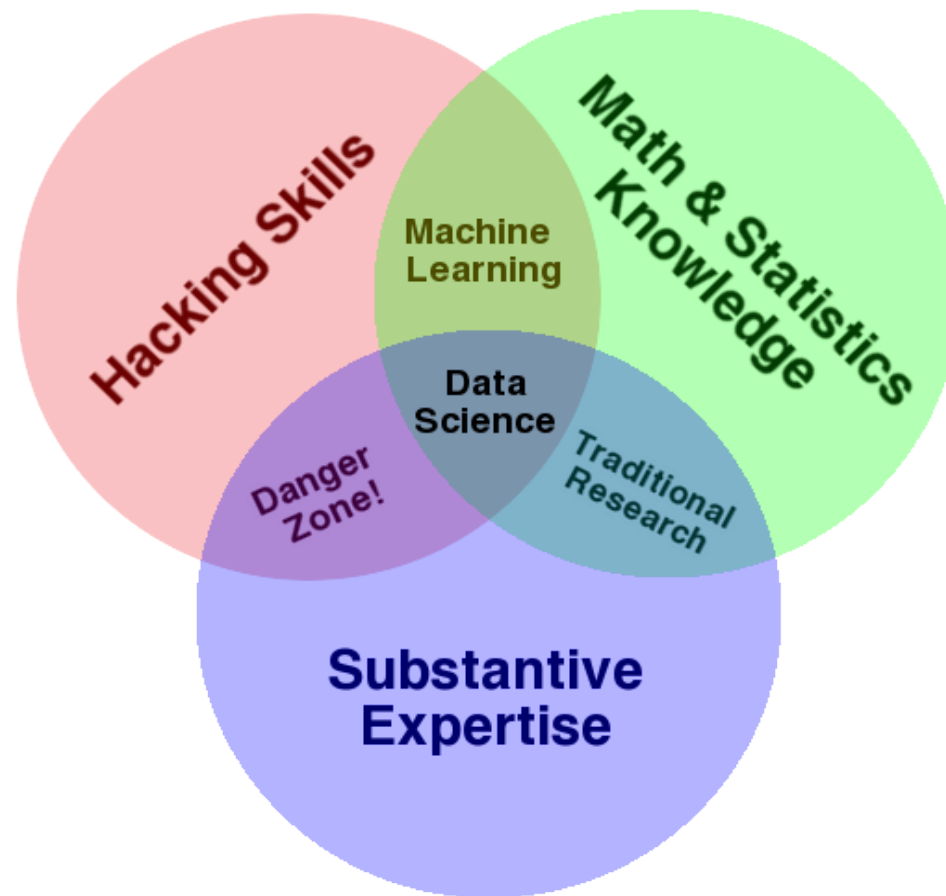
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# Data Scientist

- *Data Scientist: The Sexiest Job of the 21st Century.*  
*Harvard Business Review.*
- **Data Scientist** applies advanced **analytical** tools and algorithms to generate **predictive insights** and **new** product **innovations** that are a direct result of the data.

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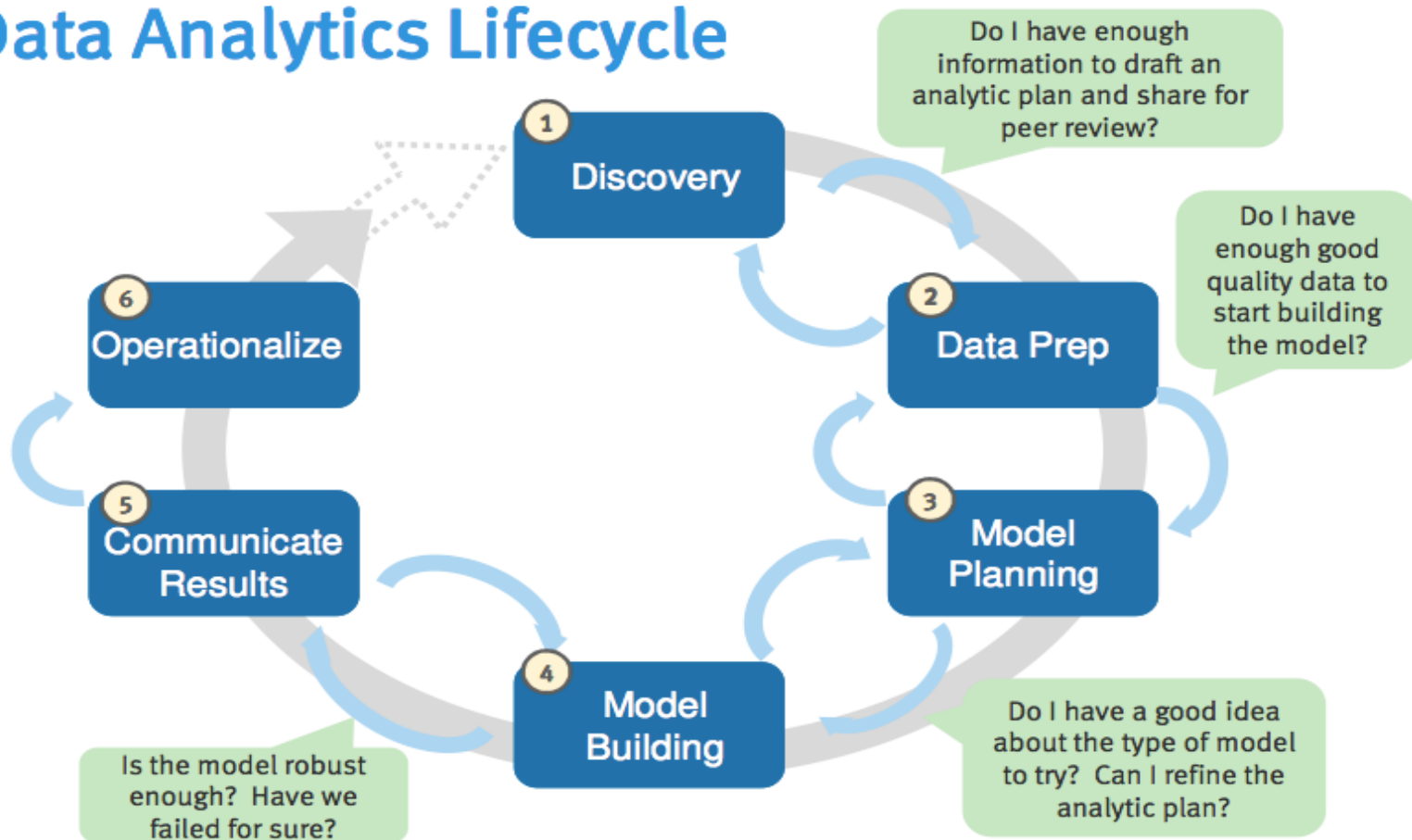
# Data Science Venn Diagram



<http://www.drewconway.com/zia/?p=2378>

# Ciclo típico de um projeto

## Data Analytics Lifecycle



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# References

- [1] Data, data everywhere. a special report on managing information. *The Economist*, pages 1–16, February 2010.