SAP INSIDE TRACK 2015
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Machine Learning 101 – Por onde começar?

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14 de Agosto de 2015

SAP

Programador desde os 16 anos, trabalhando com SAP ABAP desde 2004. Palestrante desde 2009 em eventos da comunidade SAP no Brasil, SAP Mentor desde 2014.

Big Data?

Data Science?

Artificial Intelligence?

Machine Learning?

Big Data?

Data Science?

Artificial Intelligence?

Machine Learning?

Dan Ariely

January 6, 2013 ·

Follow

Big data is like teenage sex: everyone talks about it, nobody really knows how to do it, everyone thinks everyone else is doing it, so everyone claims they are doing it...

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Big Data?

Data Science?

Artificial Intelligence?

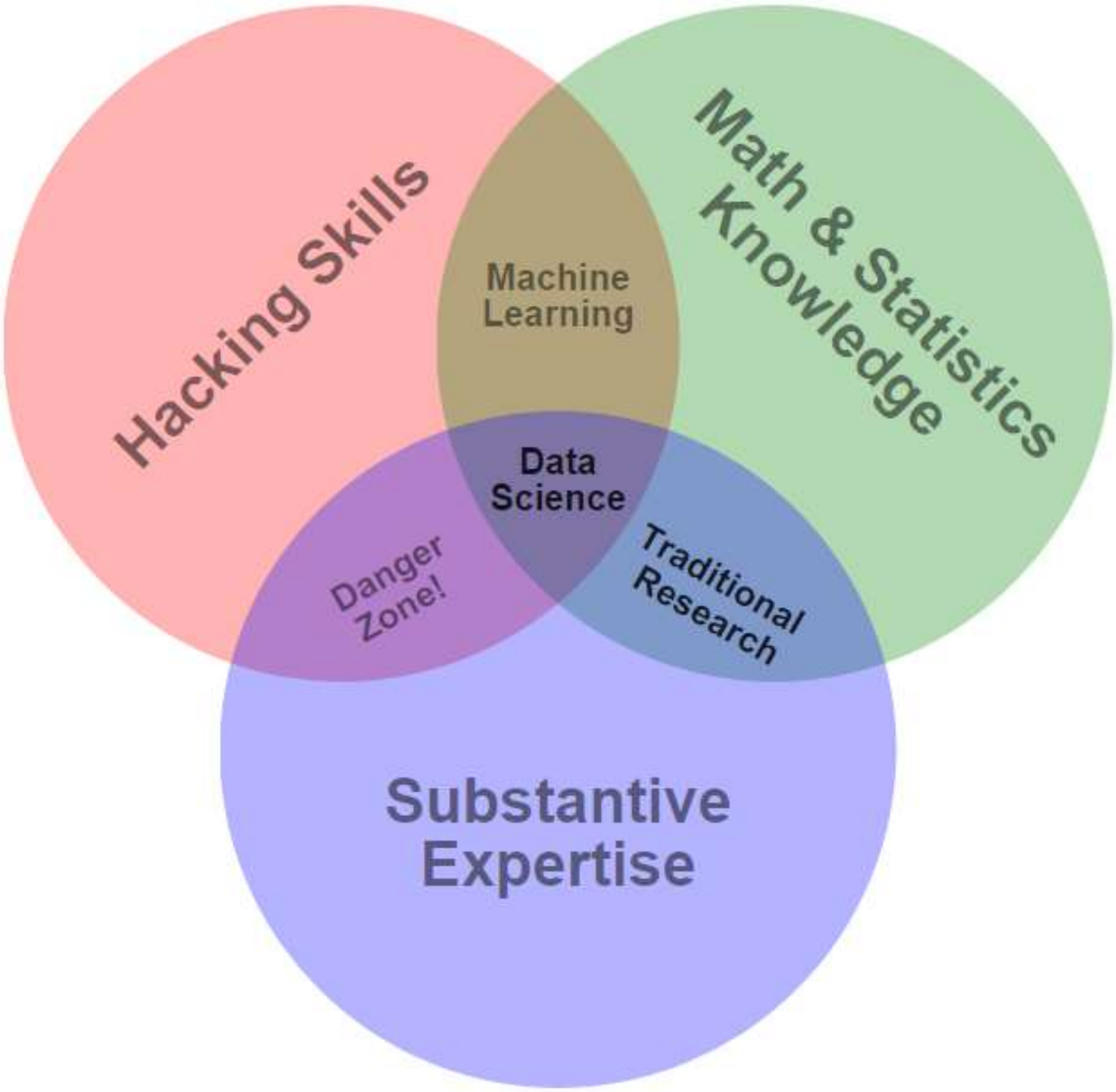
Machine Learning?

Harvard Business Review

DATA

Data Scientist: The Sexiest Job of the 21st Century

by Thomas H. Davenport and D.J. Patil


Hacking Skills
Math & Statistics Knowledge
Machine Learning
Data Science
Danger Zone!
Traditional Research
Substantive Expertise

Data Scientist

Data Scientist

SCIENTIST!

“In God we trust. All others must bring data”

Data Scientist Skills:

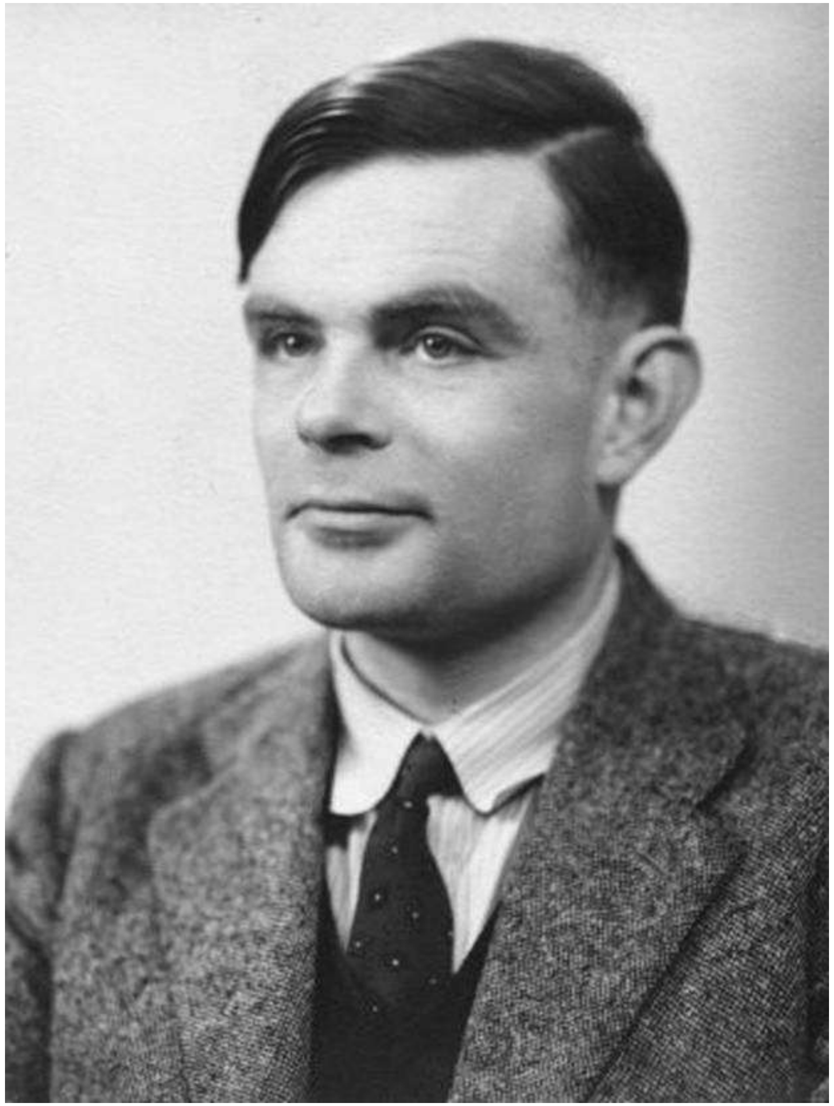
- Negócio (adm, economia, etc)
- Matemática (cálculo, estatística, radial basis function)
- Computação (programação, cloud, in-memory database)

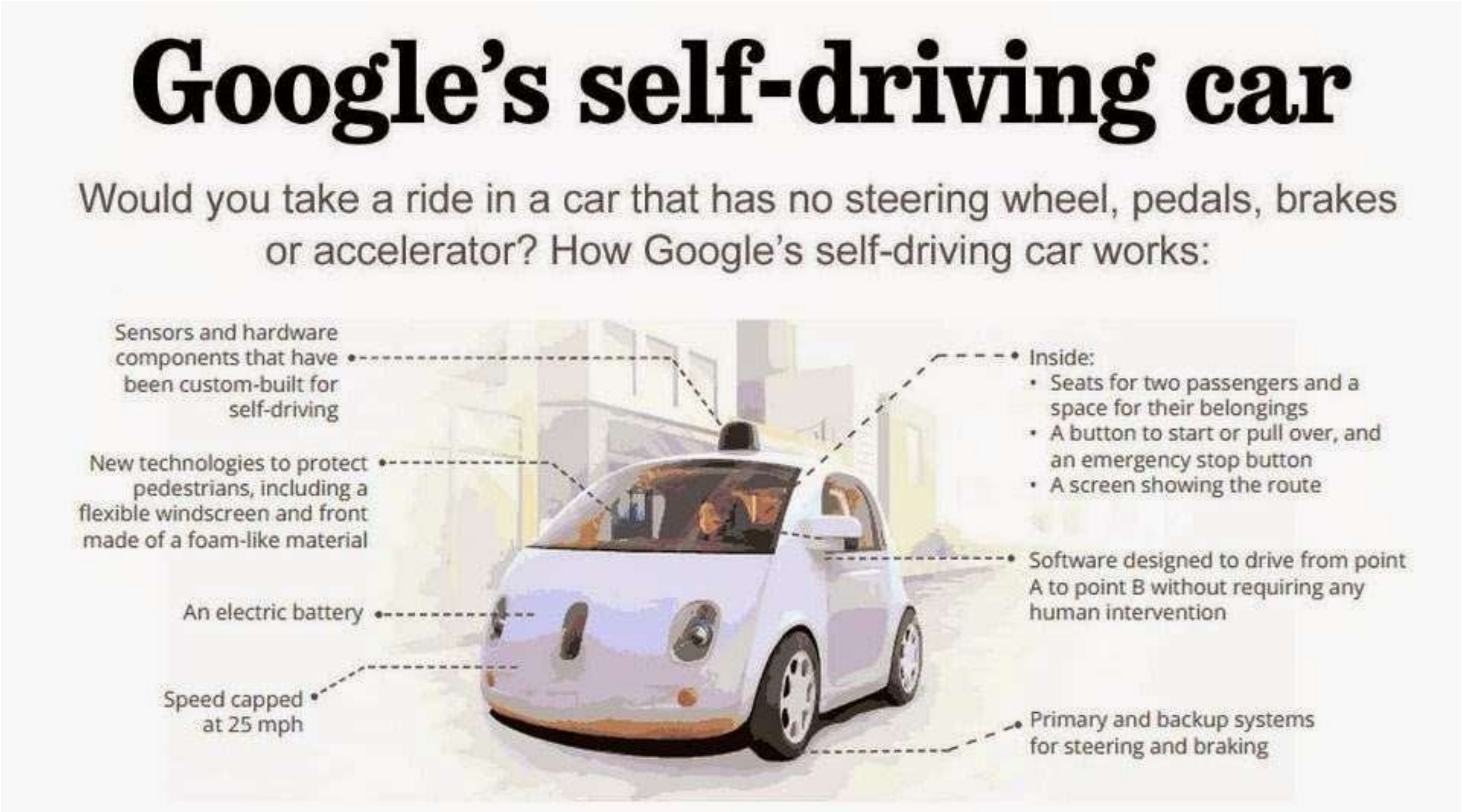
Big Data?

Data Science?

Artificial Intelligence?

Machine Learning?




Google's self-driving car
Would you take a ride in a car that has no steering wheel, pedals, brakes or accelerator? How Google's self-driving car works:
Sensors and hardware components that have been custom-built for self-driving
New technologies to protect pedestrians, including a flexible windscreen and front made of a foam-like material
An electric battery
Speed capped at 25 mph
Inside:
• Seats for two passengers and a space for their belongings
• A button to start or pull over, and an emergency stop button
• A screen showing the route
Software designed to drive from point A to point B without requiring any human intervention
Primary and backup systems for steering and braking

01/07/2015 21h18 - Atualizado em 01/07/2015 21h25

Robô agarra e mata trabalhador dentro de fábrica da Volkswagen

Caso aconteceu nesta segunda-feira (29) em planta situada na Alemanha. Autoridades investigam se há quem culpar pela morte.

Do G1, em São Paulo

FACEBOOK

Fábrica da Volkswagen em Baunatal (Foto: Feuermond16/Creative Commns)

Big Data?

Data Science?

Artificial Intelligence?

Machine Learning?

How Artificial Intelligence Is Primed to Beat You at Where's Waldo

BY JASON DORRIER ON MAY 17, 2015

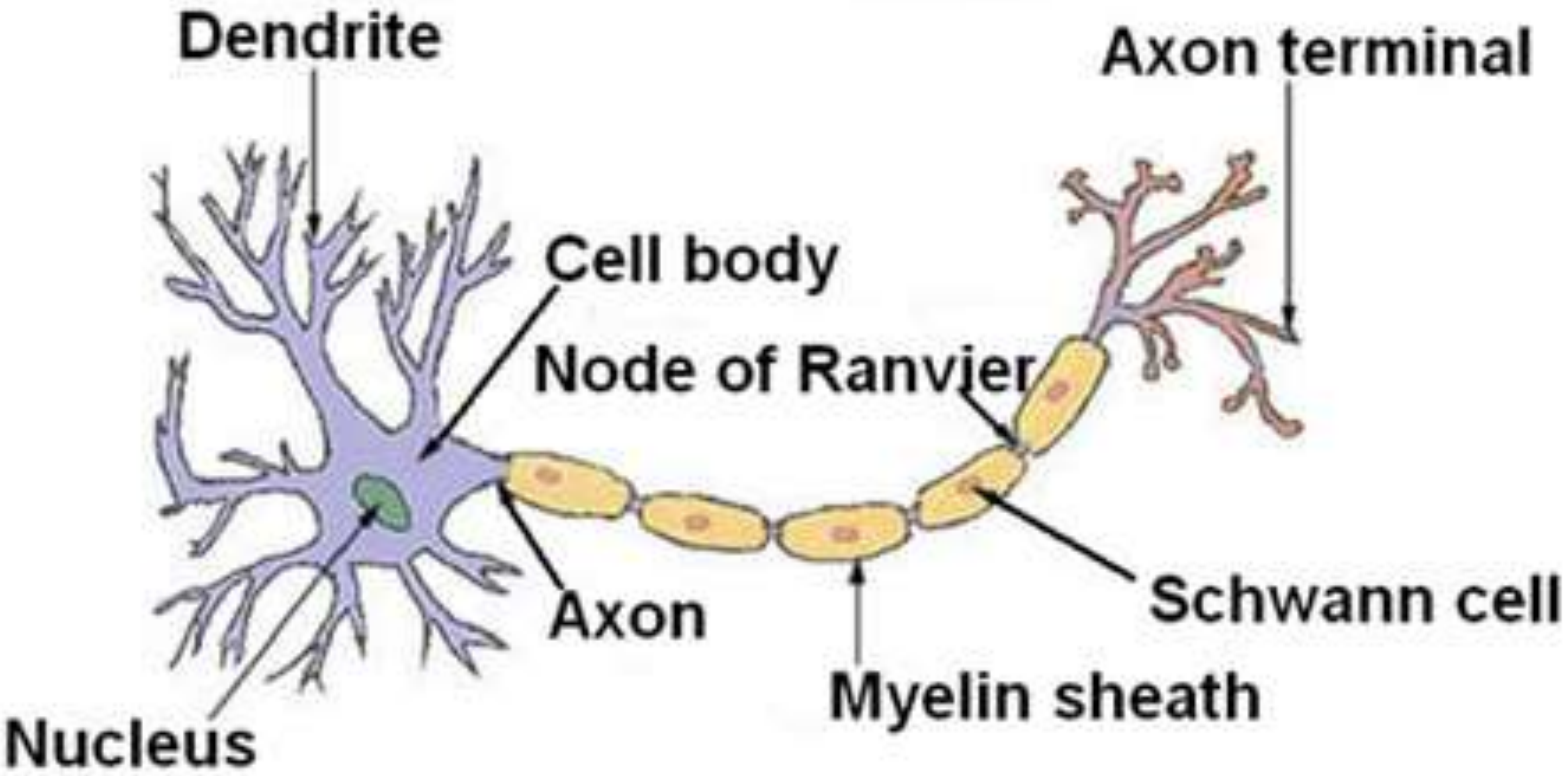
| ARTIFICIAL INTELLIGENCE, BIG DATA & DATA VISUALIZATION, FEATURED, ROBOTS, TECH

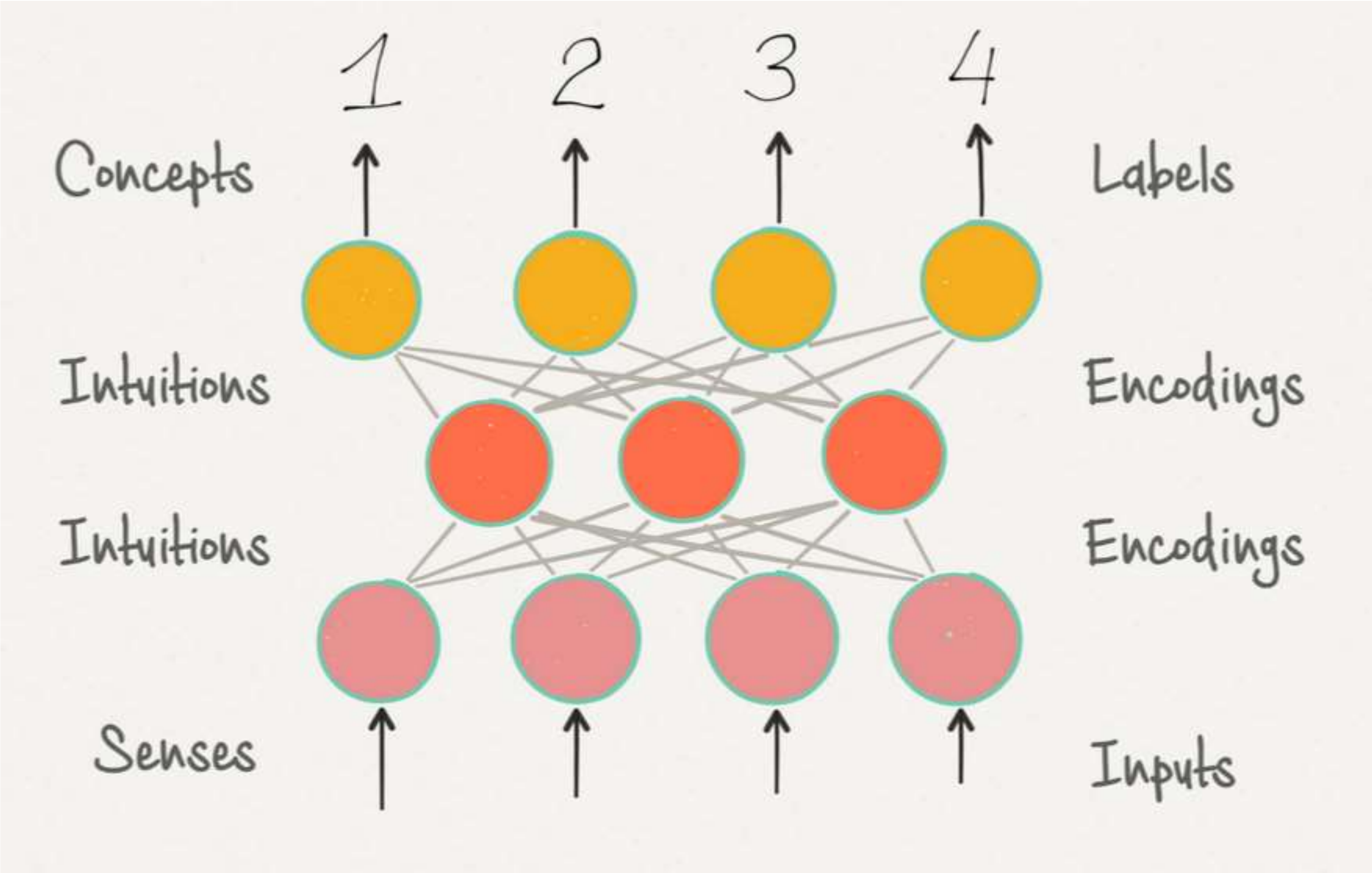
7,564 2

By their second birthday, children are learning the names of things. What's this? Cat. And this? Whale. Very good. What's this color? Red! That's right. You love red. The human brain is good at making some cognitive tasks look easy—when they aren't easy at all. Teaching software to recognize objects, for example, has been a challenge in computer science. And up until a few years ago, computers were pretty terrible at it.

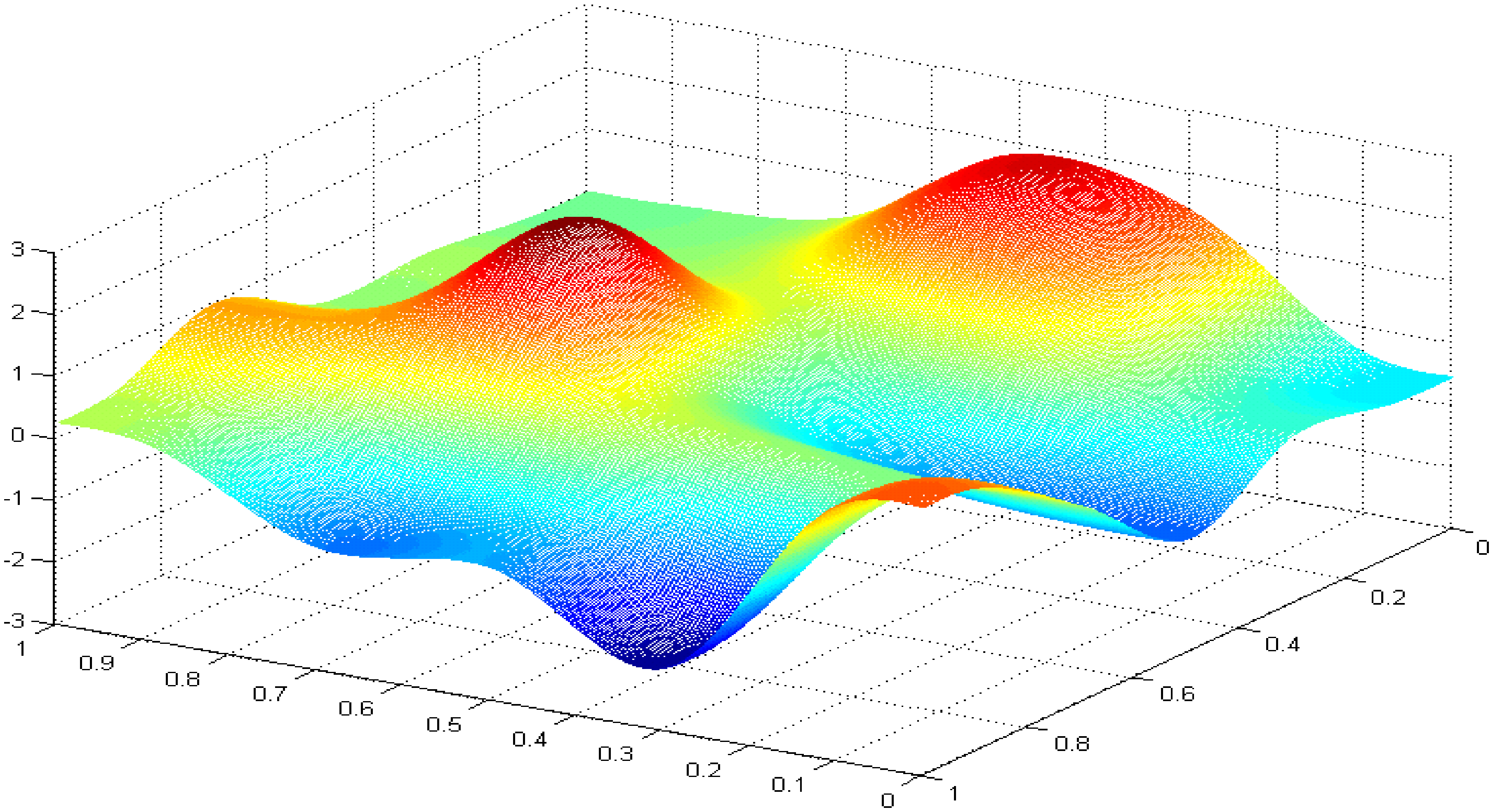
However, like many things once the sole domain of humans, machines are rapidly improving their ability to slice and dice, sort and name objects like we do.

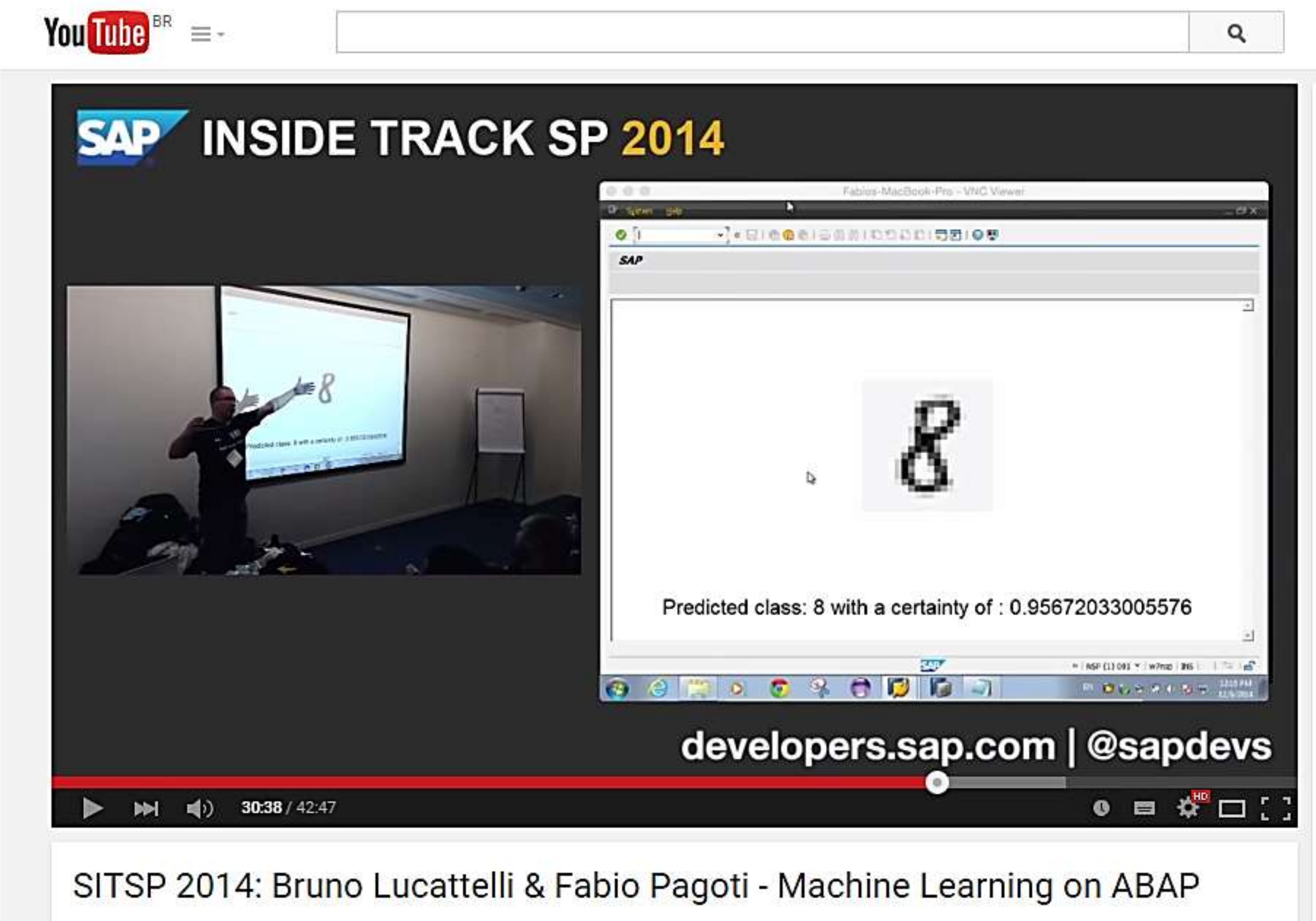
Earlier this year, Microsoft revealed its image recognition software was wrong just 4.94% of the time—it was the first to beat an expert human error rate of 5.1%. A month later,


Dendrite
Axon terminal
Cell body
Node of Ranvier
Axon
Schwann cell
Myelin sheath
Nucleus


1
2
3
4
Concepts
Labels
Intuitions
Encodings
Intuitions
Encodings
Senses
Inputs

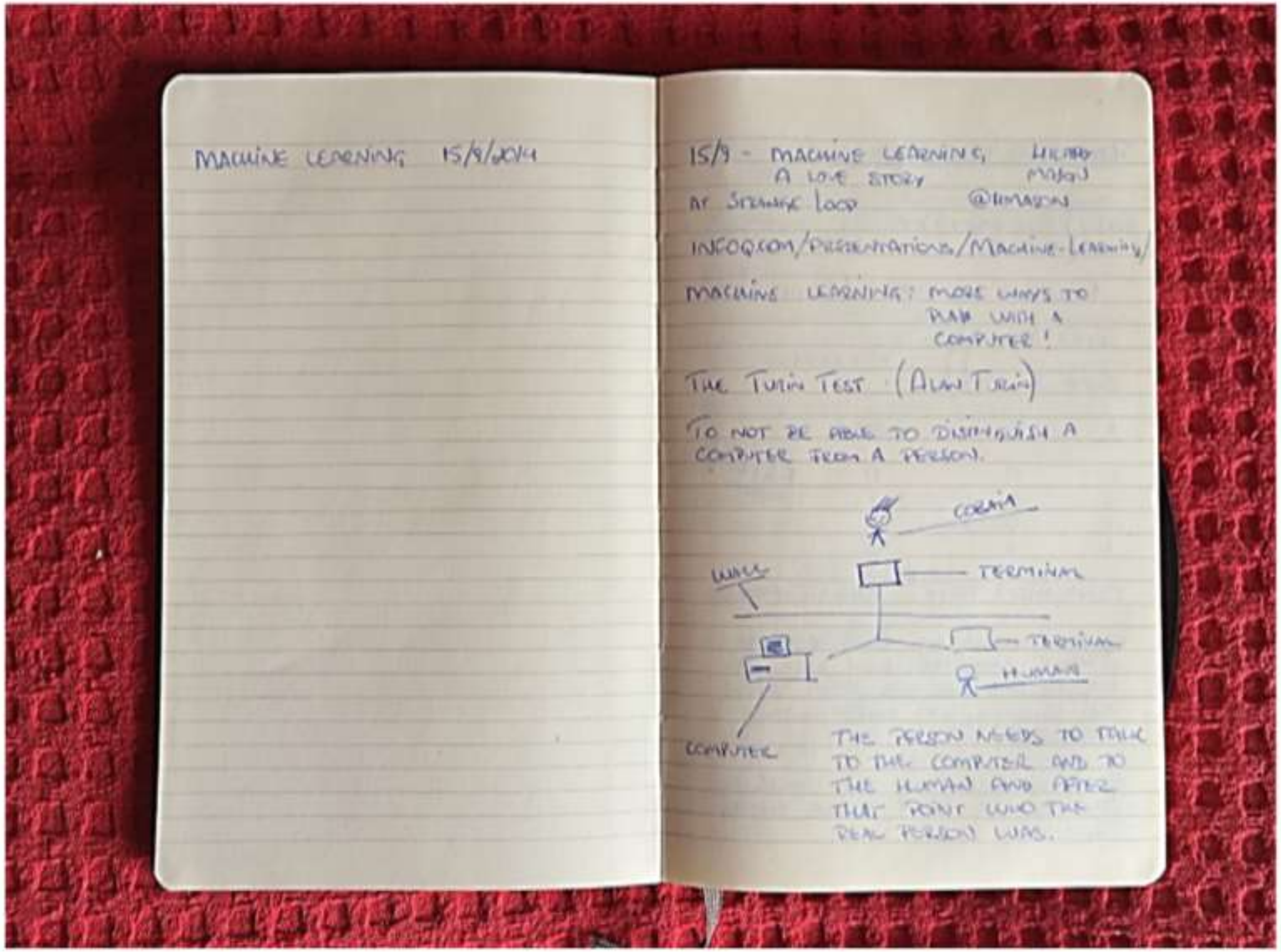
$$J(\Theta) = -\frac{1}{m}\left[\sum_{i=1}^{m}\sum_{k=1}^{K} y_k^{(i)} \log h_\theta(x^{(i)})_k + (1 - y_k^{(i)}) \log(1 - h_\theta(x^{(i)})_k)\right] + \frac{\lambda}{2m}\sum_{l=1}^{L-1}\sum_{i=1}^{s_l}\sum_{j=1}^{s_{l+1}}(\Theta_j^{(l)})^2$$


3
2
1
0
-1
-2
-3
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.2
0.4
0.6
0.8
1

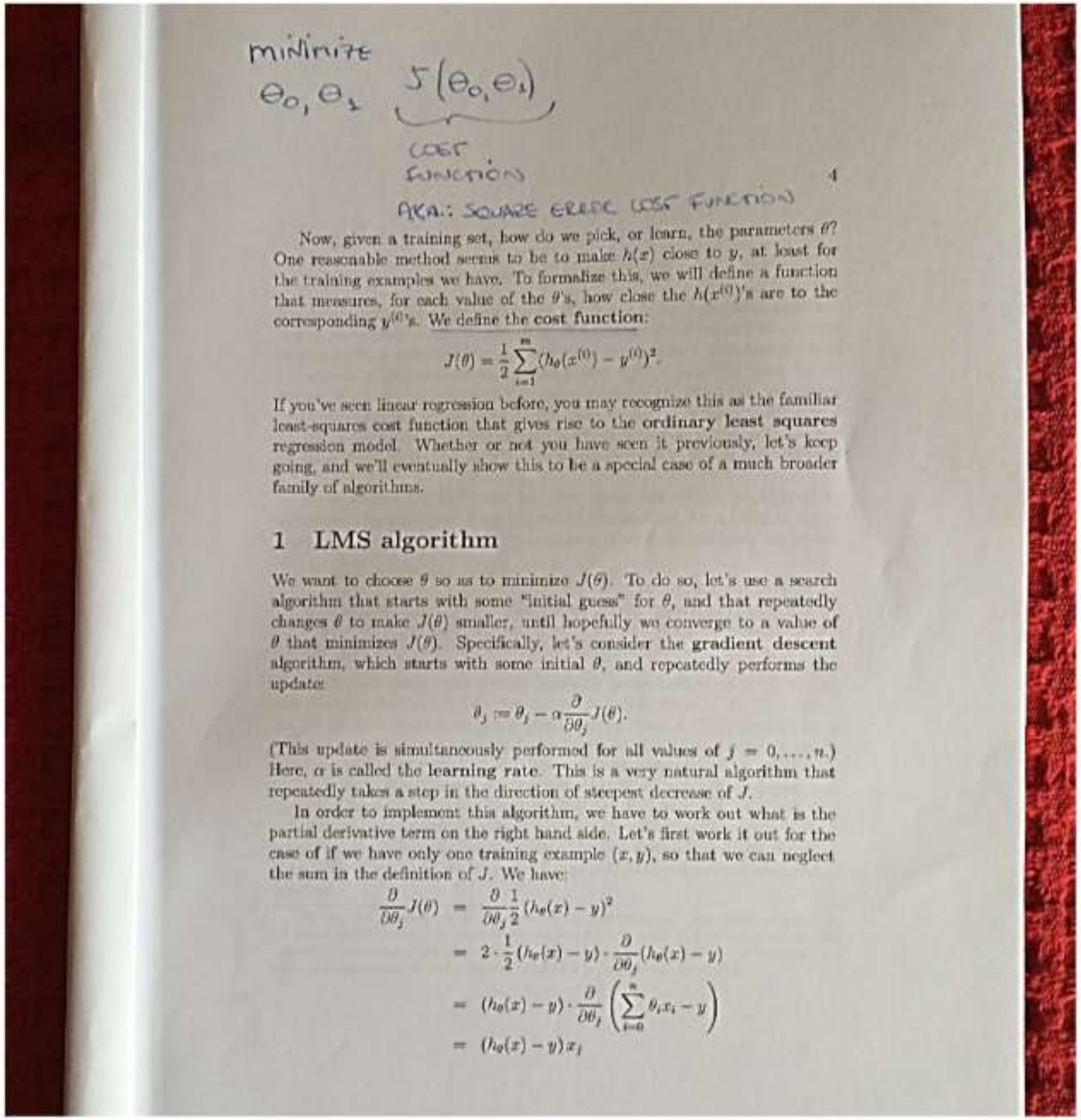

YouTube BR
INSIDE TRACK SP 2014
Predicted class: 8 with a certainty of : 0.95672033005576
developers.sap.com | @sapdevs
30:38 / 42:47
SITSP 2014: Bruno Lucattelli & Fabio Pagoti - Machine Learning on ABAP

Demo

Rede neural em ABAP



MACHINE LEARNING 15/9/2014
15/9 - MACHINE LEARNING, A LOVE STORY
AT STRANGE LOOP
@IMASON
INFOQ.COM/PRESENTATIONS/MACHINE-LEARNING/
MACHINE LEARNING: MORE WAYS TO PLAY WITH A COMPUTER!
THE TURIN TEST (ALAN TURIN)
TO NOT BE ABLE TO DISTINGUISH A COMPUTER FROM A PERSON.
TERMINAL
WALL
TERMINAL
HUMAN
COMPUTER
THE PERSON NEEDS TO TALK TO THE COMPUTER AND TO THE HUMAN AND AFTER THAT POINT WHO THE REAL PERSON WAS.



minimize
$$\min_{\theta_0, \theta_1} \underbrace{J(\theta_0, \theta_1)}_{\text{cost function}}$$

AKA.: SQUARE ERROR COST FUNCTION

Now, given a training set, how do we pick, or learn, the parameters θ? One reasonable method seems to be to make $h(x)$ close to y, at least for the training examples we have. To formalize this, we will define a function that measures, for each value of the θ's, how close the $h(x^{(i)})$'s are to the corresponding $y^{(i)}$'s. We define the **cost function**:

$$J(\theta) = \frac{1}{2}\sum_{i=1}^{m}(h_\theta(x^{(i)}) - y^{(i)})^2.$$

If you've seen linear regression before, you may recognize this as the familiar least-squares cost function that gives rise to the **ordinary least squares** regression model. Whether or not you have seen it previously, let's keep going, and we'll eventually show this to be a special case of a much broader family of algorithms.

1 LMS algorithm

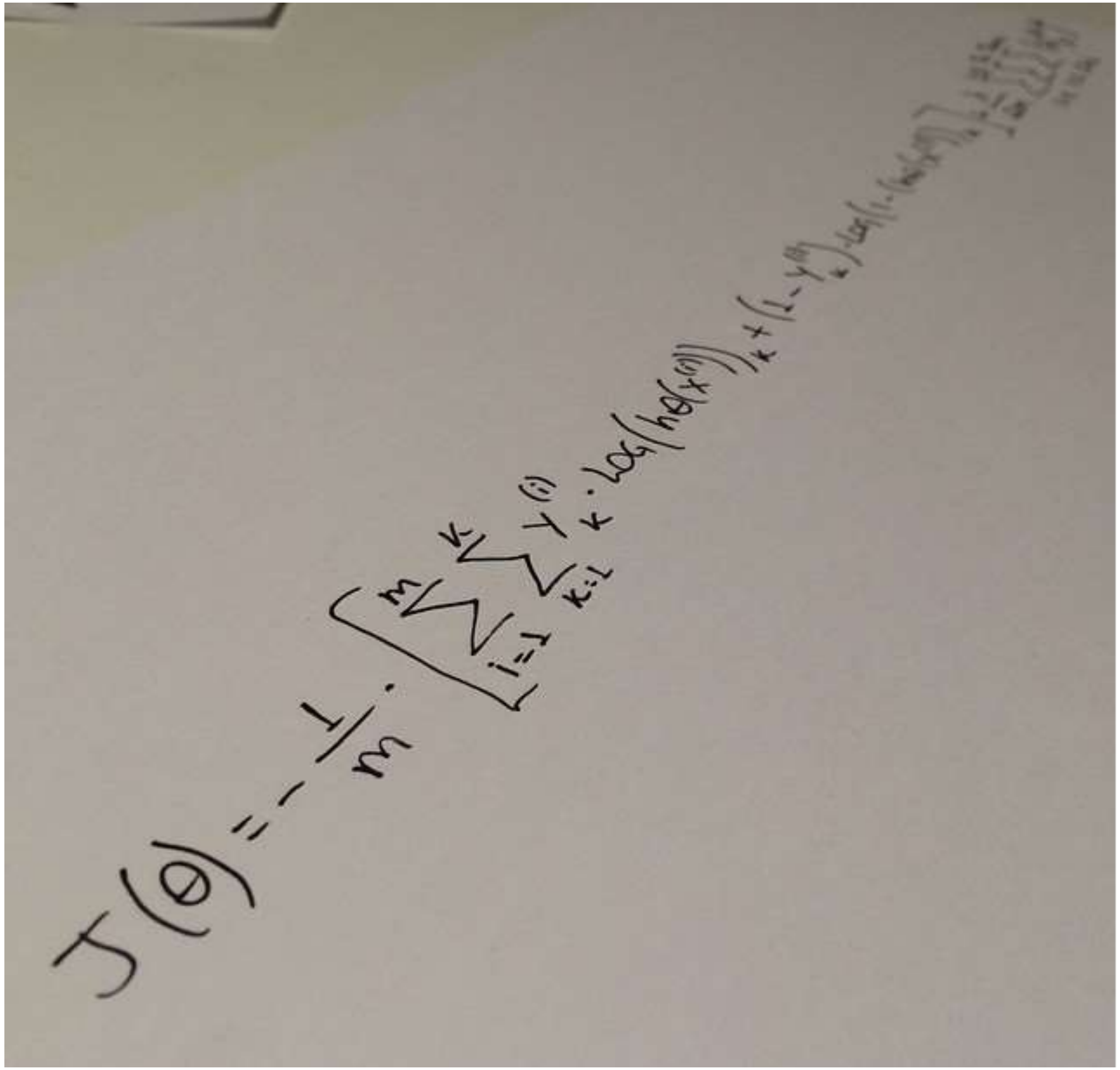
We want to choose θ so as to minimize $J(\theta)$. To do so, let's use a search algorithm that starts with some "initial guess" for θ, and that repeatedly changes θ to make $J(\theta)$ smaller, until hopefully we converge to a value of θ that minimizes $J(\theta)$. Specifically, let's consider the **gradient descent** algorithm, which starts with some initial θ, and repeatedly performs the update:

$$\theta_j := \theta_j - \alpha\frac{\partial}{\partial\theta_j}J(\theta).$$

(This update is simultaneously performed for all values of $j = 0, \ldots, n$.) Here, α is called the **learning rate**. This is a very natural algorithm that repeatedly takes a step in the direction of steepest decrease of J.

In order to implement this algorithm, we have to work out what is the partial derivative term on the right hand side. Let's first work it out for the case of if we have only one training example (x, y), so that we can neglect the sum in the definition of J. We have:

$$\begin{aligned}
\frac{\partial}{\partial\theta_j}J(\theta) &= \frac{\partial}{\partial\theta_j}\frac{1}{2}(h_\theta(x) - y)^2 \\
&= 2\cdot\frac{1}{2}(h_\theta(x) - y)\cdot\frac{\partial}{\partial\theta_j}(h_\theta(x) - y) \\
&= (h_\theta(x) - y)\cdot\frac{\partial}{\partial\theta_j}\left(\sum_{i=0}^{n}\theta_i x_i - y\right) \\
&= (h_\theta(x) - y)\,x_j
\end{aligned}$$



lucattelli FOLLOW

19 likes 36w

lucattelli Estuda, fiadapu!

alcardebruna Bonito desenho!

camilacv São hieróglifos!

fernandavazdecampos Estudando cultura egípcia?

Log in to like or comment.

ABAP Editor: Change Include ZICA_ML

Pattern Pretty Printer

Include ZICA_ML Active

```
 * PART5: LINEAR REGRESSION WITH MULTIPLE FEATURES

*&---------------------------------------------------------------------*
*&      Form  hypothesis
*&---------------------------------------------------------------------*
*       Return a hypothesis of Y for X by multiplying it by THETA param
*----------------------------------------------------------------------*
FORM hypothesis TABLES t_theta t_x CHANGING hypothesis.
  DATA : theta TYPE type_float,
         x TYPE type_float,
         h TYPE type_float.
  LOOP AT t_theta INTO theta.
    READ TABLE t_x INDEX sy-tabix INTO x.
    CHECK sy-subrc IS INITIAL.
    h = h + ( theta * x ).
  ENDLOOP.
  hypothesis = h.
ENDFORM.                    "hypothesis
```

ABAP Editor: Change Report ZICA_ML_NN

Pattern Pretty Printer

Report ZICA_ML_NN Active

```
*&---------------------------------------------------------------------*
*&      Form  sigmoid_function
*&---------------------------------------------------------------------*
*       Implements the Sigmoid Function for Logistic Regression
*----------------------------------------------------------------------*
FORM sigmoid_function TABLES iz og.
  DATA  : t_z TYPE type_float_vector,
          z TYPE type_float,
          t_g TYPE type_float_vector,
          g TYPE type_float.

  t_z[] = iz[].

  LOOP AT t_z INTO z.
    g = 1 / ( 1 + c_e ** ( -1 * z ) ).
    APPEND g TO t_g.
  ENDLOOP.

  og[] = t_g[].

ENDFORM.                    "sigmoid_function
```

Então, por onde começar?

Quanto vale uma casa?

M^2	$
100	...
200	...
300	...

0 ∞

Quanto vale uma casa?

$1\ M^2 = \$\ 500$

Quanto vale uma casa?

M^2	$
100	50.000
200	100.000
300	150.000

0 ∞

Quanto vale uma casa?

Intuição.

Quanto vale uma casa?

M^2	$
100	100.000,00
200	...
300	300.000,00

Quanto vale uma casa?

Se:

$1\ M^2 = \$\ 1.000$

Logo:

$200\ M^2 \times 1.000 = 200.000$

Quanto vale uma casa?

M^2	$
100	100.000,00
200	200.000,00
300	300.000,00

0 ∞

Paradigmas

	SERES HUMANOS	COMPUTADORES
OBSERVAÇÃO (Casas de 100 M^2 e 300 M^2)	Usada para gerar intuição.	N/A
MODELO (1 M^2 = 1.000)	Aplicado a partir da intuição gerada.	Aplicado a partir de programação.
DADO REPRODUZIDO (Casa de 200 M^2)	Obtido a partir da aplicação do modelo.	Obtido a partir da aplicação do modelo.

Aprender a programar

Aprender Machine Learning

Introdução	História da computação
Lógica de Programação	Estimular o pensamento lógico
Algoritmos	Aprender boas práticas comuns e básicas
Linguagens Básicas	Basic, Pascal, C, Lisp, Perl
Conceitos Modernos	Orientação a objetos, Design Patterns, etc
Ferramentas Modernas	Java, C#, Objective C, Ruby, Scala, JS, Python, Git, etc...

Programação	Machine Learning
Introdução	• **The Future of Robotics and Artificial Intelligence** (Andrew Ng) youtu.be/AY4ajbu_G3k • **Machine Learning: A Love Story** (Hilary Mason) bit.ly/1lrAOvC

Programação	Machine Learning
Lógica de Programação	• **Stanford University Machine Learning** (Andrew Ng) bit.ly/1IXp8Lg • **Stanford University CS229** (Andrew Ng) cs229.stanford.edu

Programação	Machine Learning
Algoritmos	• **Math-as-code** bit.ly/1gMl49R • **Calculus 1** bit.ly/1oqkavV • **Curso Prandiano** prandiano.com.br

Programação	Machine Learning
Linguagens Básicas	• **Matlab / Octave** bit.ly/1Gzc0tV • **Scikit-learn** scikit-learn.org • **Awesome Machine Learning List** bit.ly/1t8b6QX

Programação	Machine Learning
Conceitos Modernos	• **Going Deeper Into Neural Networks** bit.ly/1BkXP09 • **Stanford University Deep Learning Tutorial** ufldl.stanford.edu/tutorial • **University of Alberta Introduction to Reinforcement Learning** bit.ly/1KffZ5P

Programação	Machine Learning
Ferramentas Modernas	• **R** r-project.org • **Apache Hadoop** hadoop.apache.org • **SAP Predictive Analytics** bit.ly/1GzeqbS

OBRIGADO!

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twitter.com/lucattelli
github.com/lucattelli/ZICA_ML