

Inteligencia Artificial

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Sistemas y Computación



CÁTEDRA *de* SEDE
José Celestino Mutis

José Celestino Mutis



2001: A Space Odyssey (1968)



Un poco de historia...



**“the thinking
machine”**

https://www.youtube.com/watch?time_continue=399&v=rBjhD1oGQg

DeepBlue vs Kasparov (1997)



<https://www.youtube.com/watch?v=NJarxpYyoFI>

DeepBlue vs Kasparov (1997)

ESPN FILMS
PRESENTS

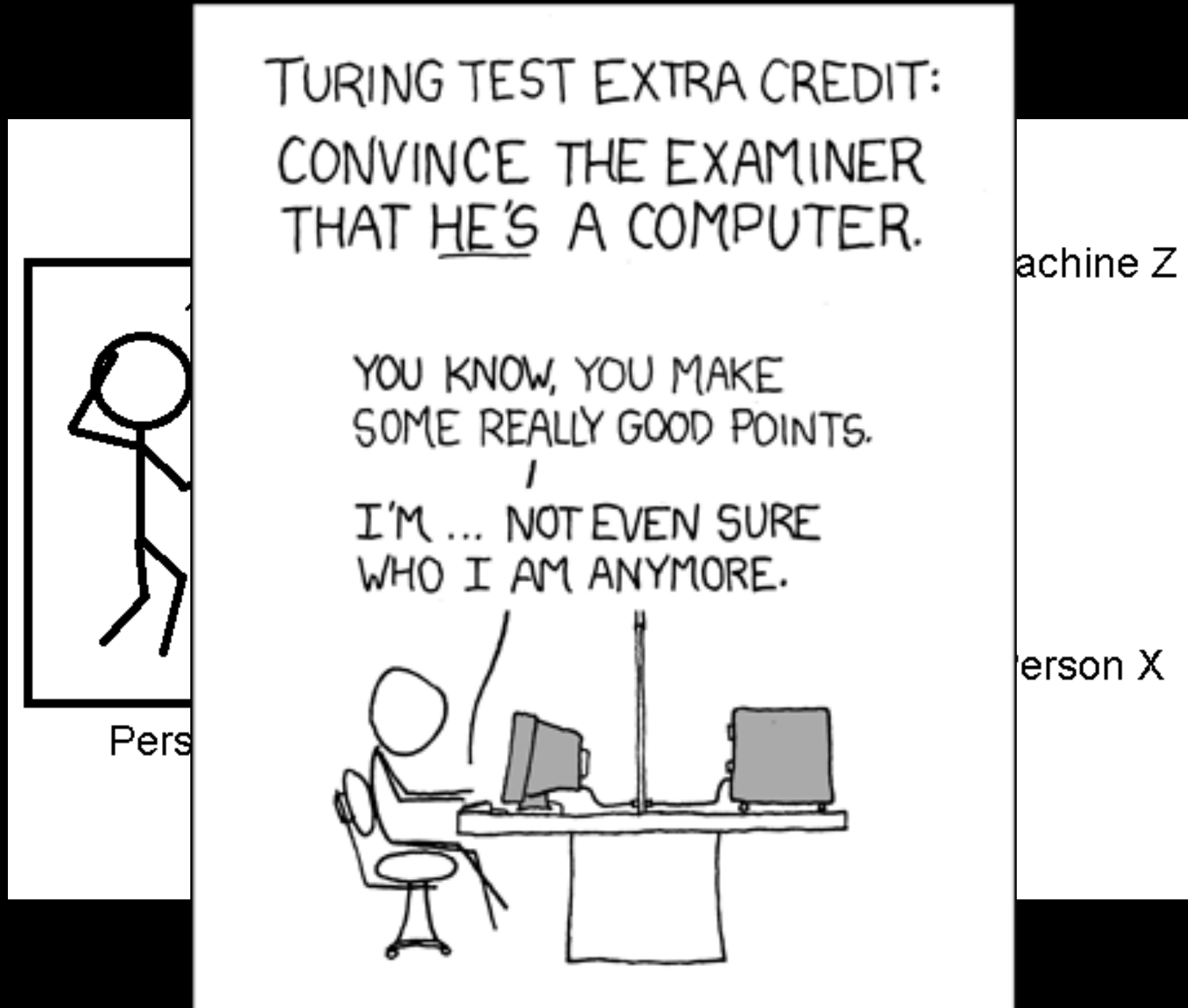


<https://www.youtube.com/watch?v=JodijRqCg6k>



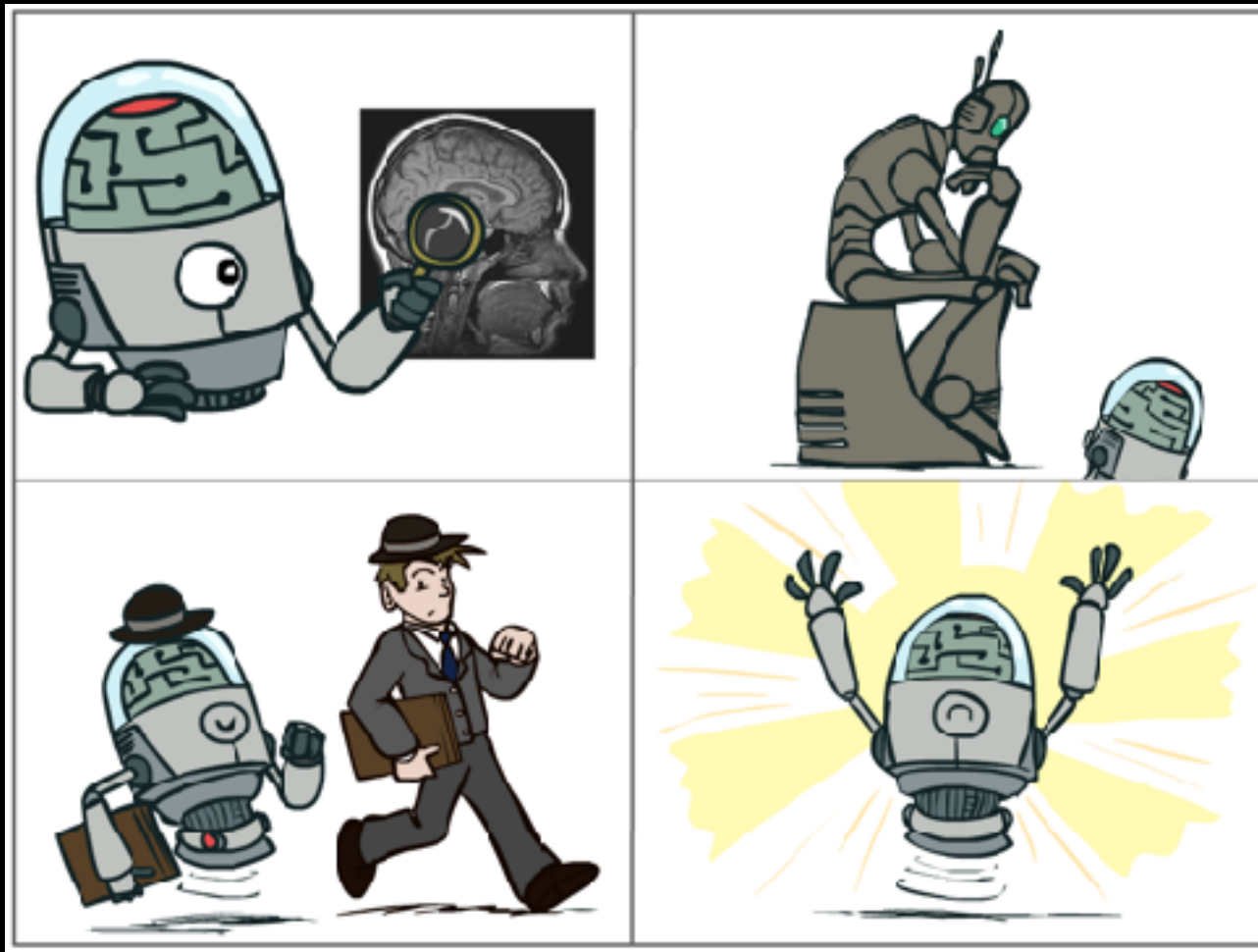
¿Qué es la
Inteligencia Artificial?

El test de Turing



Cuatro enfoques

Pensar
como
humano



Pensar
racionalmente

Actuar
como
humano

Actuar
racionalmente

Inteligencia Artificial hoy en día:

Racionalidad Computacional

- Racionalidad: Alcanzar, de manera óptima, objetivos predefinidos
- Objetivos → función de utilidad
- Actuar racionalmente → maximizar la utilidad

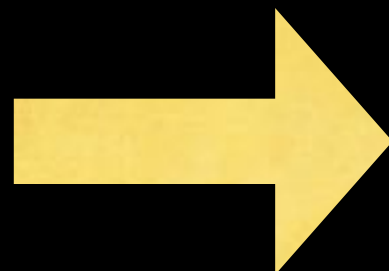


Aprendizaje Computacional

“Los computadores sólo pueden hacer lo que se les dice que hagan”

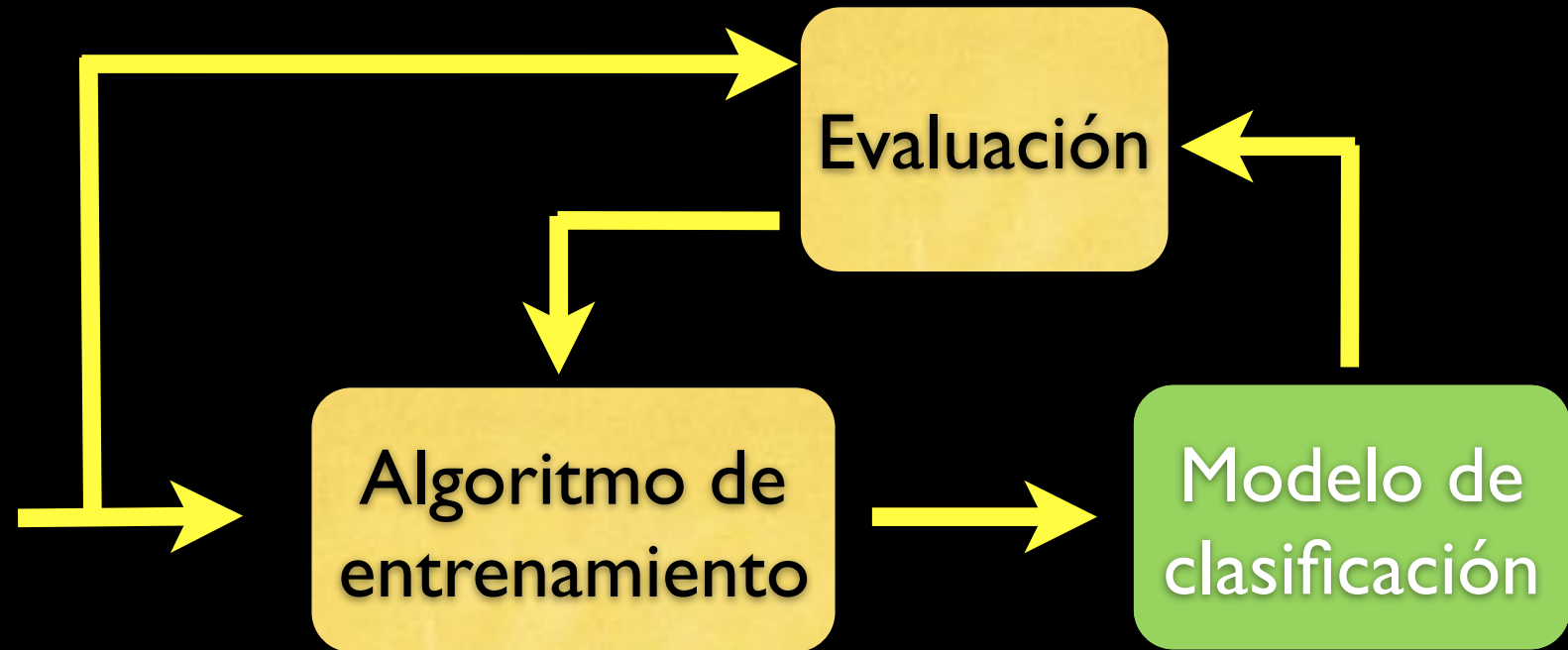
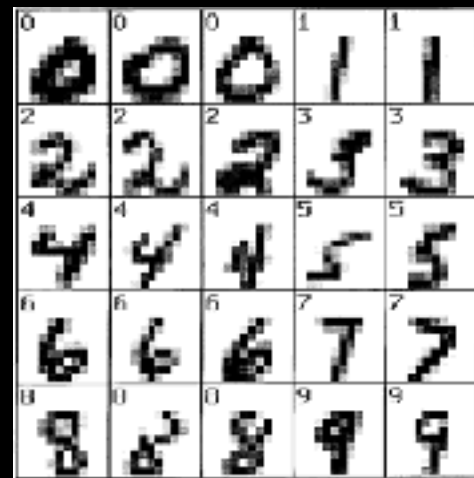
“¿Y qué tal si le decimos a la máquina que aprenda por si misma y mejore continuamente?”

1 9 9 3
1 9 9 7
1 9 9 4
1 9 6 8
1 9 9 4
1 9 9 5

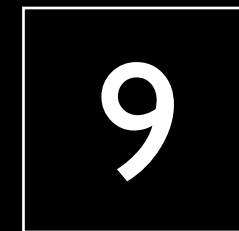


1993
1997
1994
1968
1994
1945

Entrenamiento



Predicción





Redes Neuronales

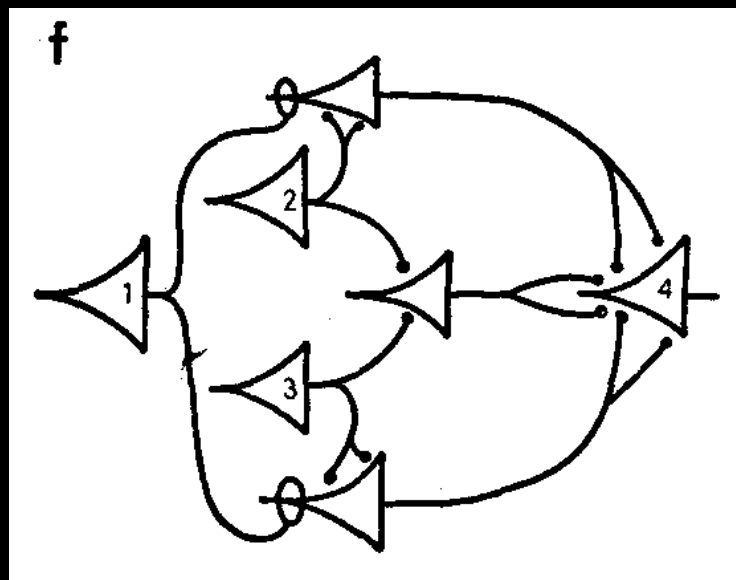
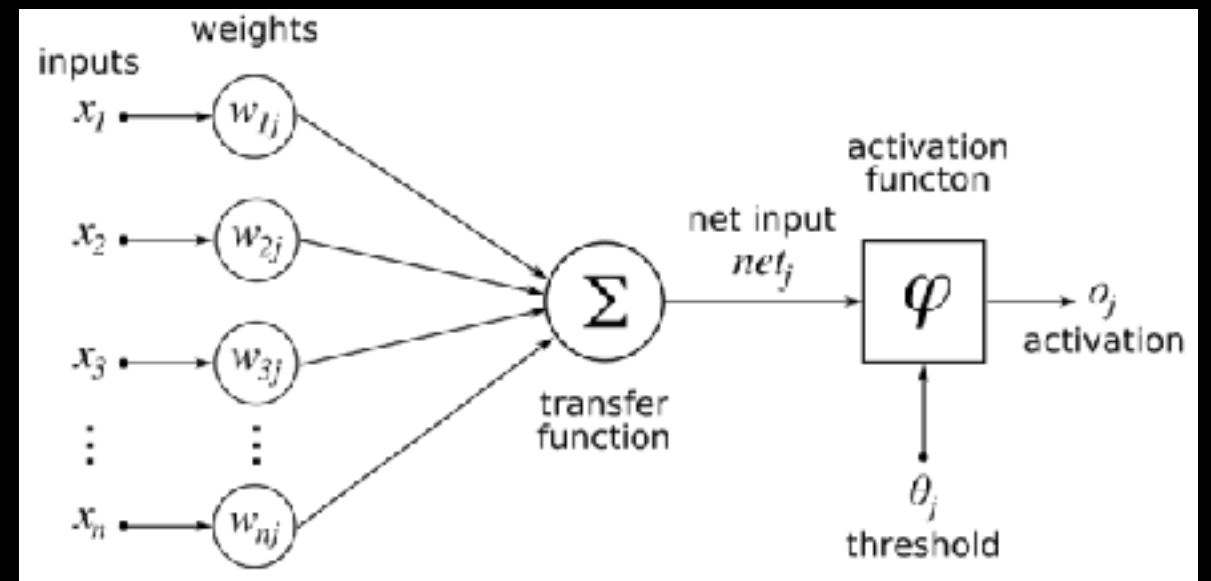
McCulloch & Pitts Artificial Neuron

BULLETIN OF
MATHEMATICAL BIOPHYSICS
VOLUME 5, 1943

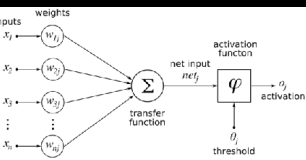
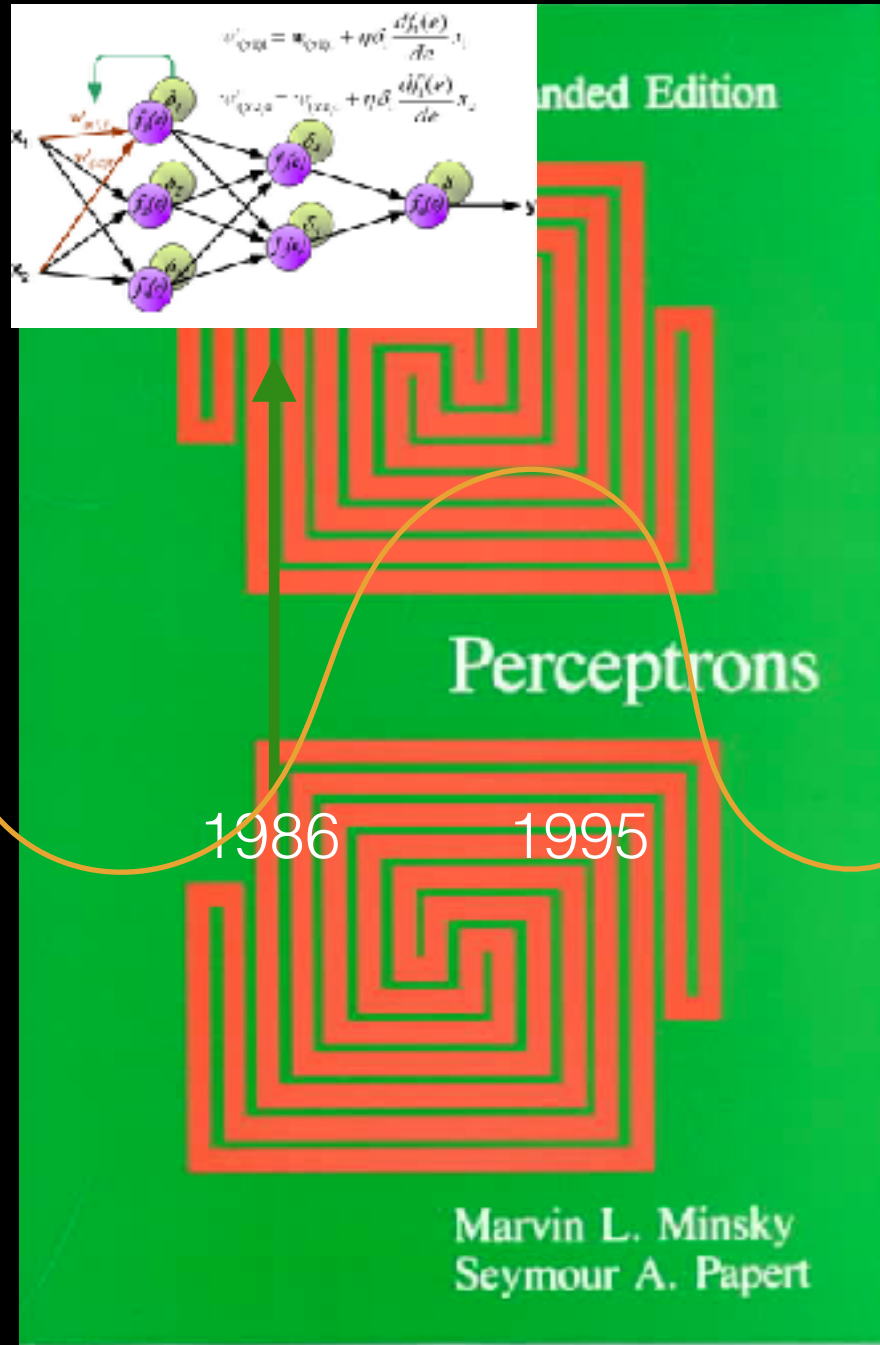
A LOGICAL CALCULUS OF THE
IDEAS IMMANENT IN NERVOUS ACTIVITY

WARREN S. MCCULLOCH AND WALTER PITTS

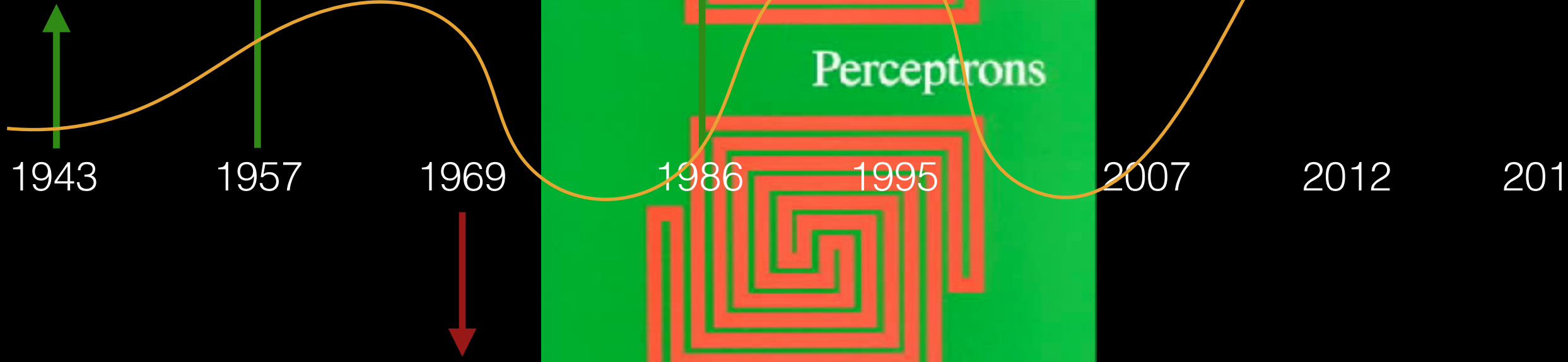
FROM THE UNIVERSITY OF ILLINOIS, COLLEGE OF MEDICINE,
DEPARTMENT OF PSYCHIATRY AT THE ILLINOIS NEUROPSYCHIATRIC INSTITUTE,
AND THE UNIVERSITY OF CHICAGO



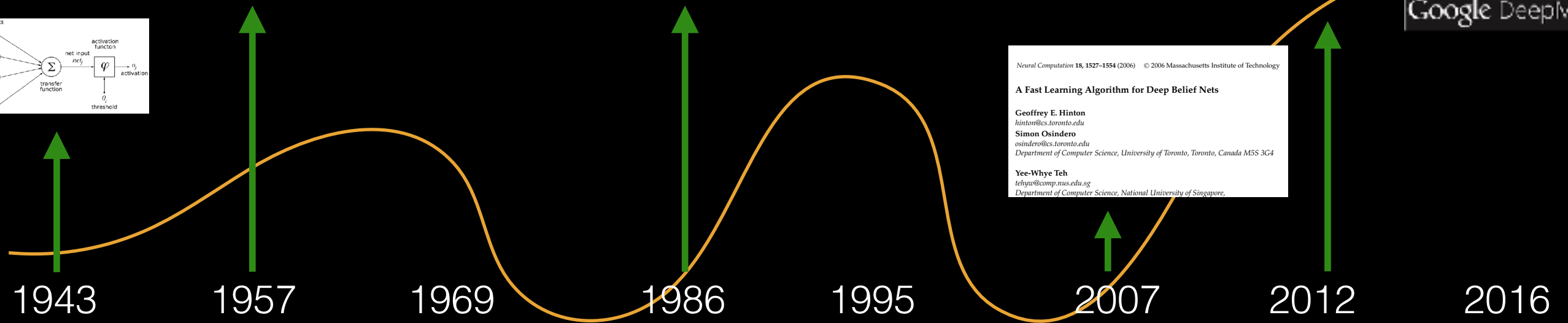
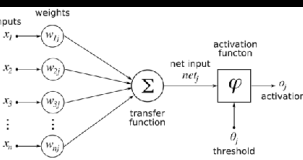
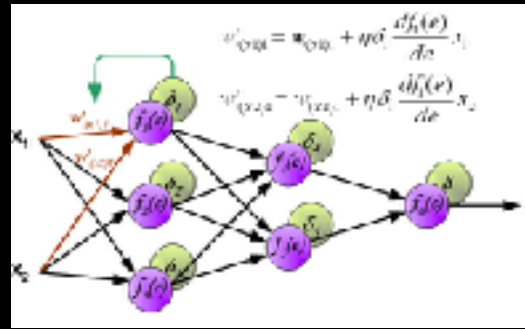
Neural networks time line



1943 1957 1969 1986 1995 2007 2012 2016



Línea de tiempo de las RNs

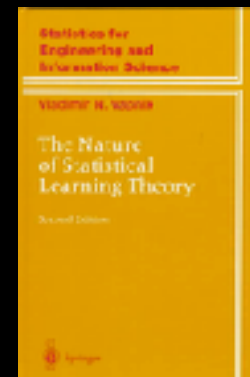
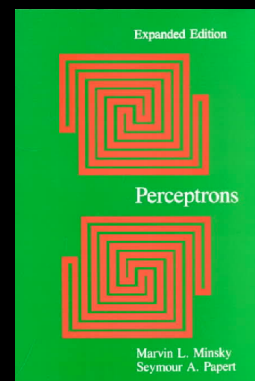


Neural Computation 18, 1527-1554 (2006) © 2006 Massachusetts Institute of Technology

A Fast Learning Algorithm for Deep Belief Nets

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Department of Computer Science, National University of Singapore.



Deep learning boom

Tech Talk | Computing | Software

Google's Deep Mind Gives AI Boost That Lets It Navigate Underground

CADE METZ BUSINESS 12.09.13 3:14 PM

FACEBOOK TAPS 'DEEP LEARNING' GIANT FOR NEW AI LAB

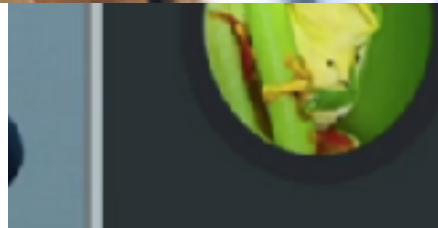
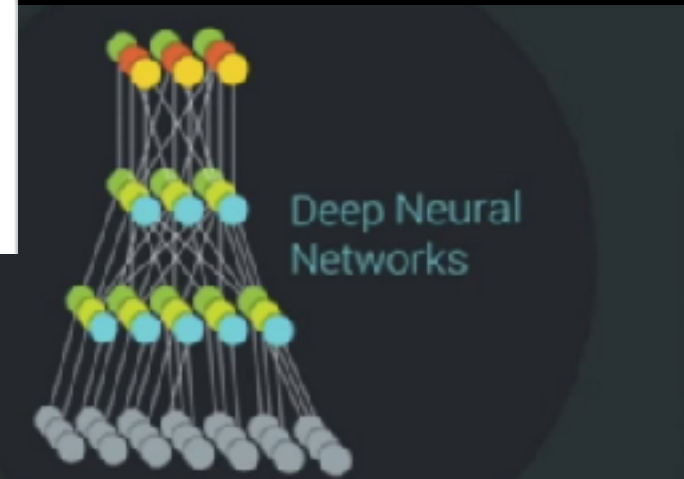
ROBERT MCMILLAN BUSINESS 03.13.13 6:30

GOOGLE HIRES BHELPER WHO HELPED SUPERCOMPUTER MACHINE LEARNING

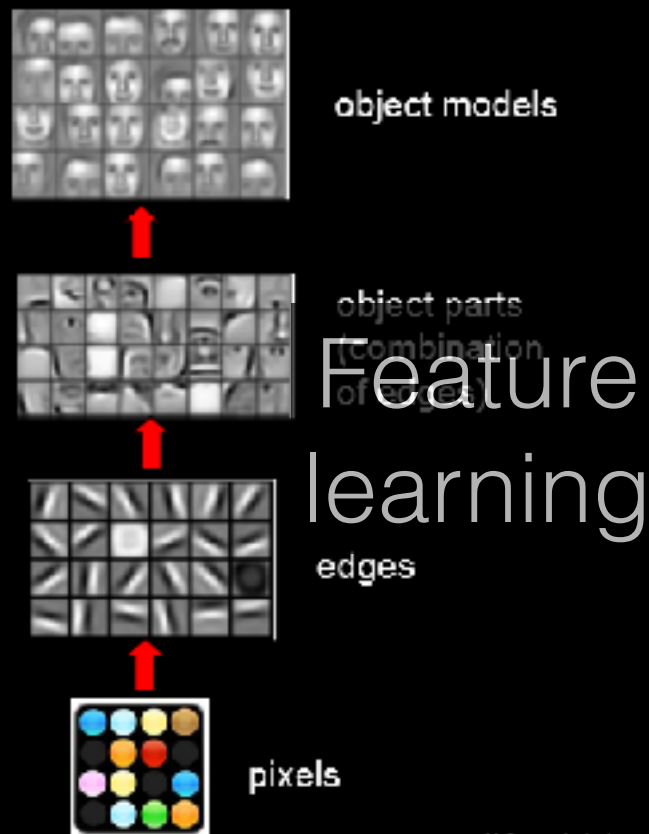
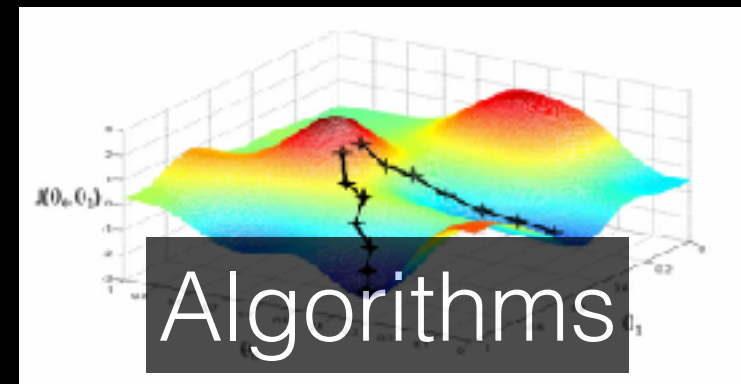
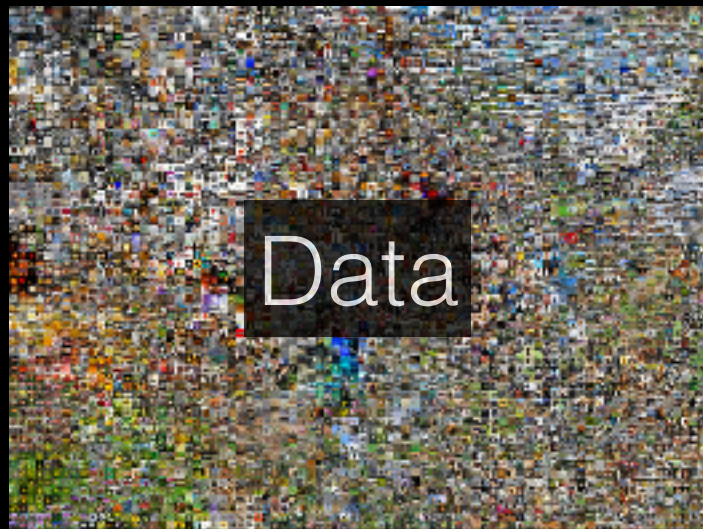
MIT Technology Review



Research Giant Man Behind 'Brain'



Deep learning recipe

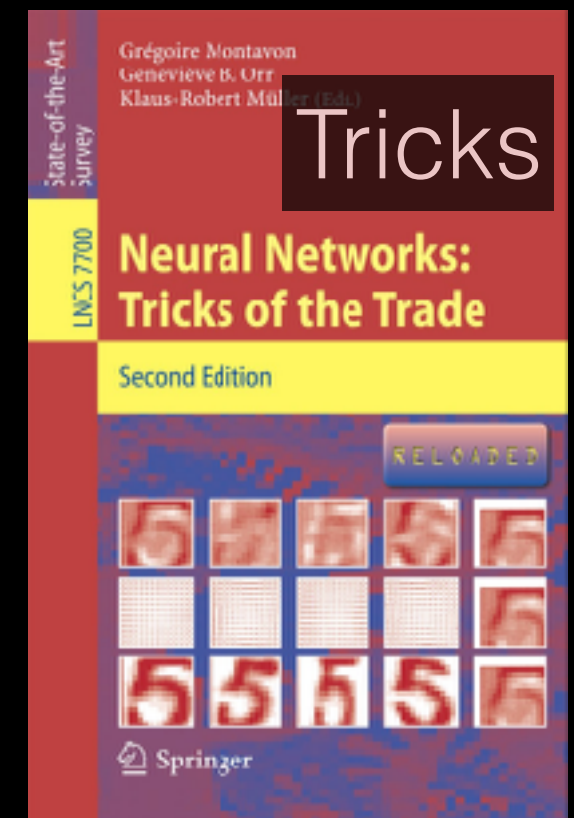


[Honglak I

Won the 2012 ImageNet ILSVRC. 60 Million parameters, 832M MAC ops

4M	FULL CONNECT	4M800
10M	FULL 4096/ReLU	10M
37M	FULL 4096/ReLU	37M
	MAX POOLING	
442K	CONV 3x3/ReLU 256fm	71M
1.2M	CONV 3x3/ReLU 128fm	1.2M
804K	CONV 3x3/ReLU 128fm	804K
	MAX POOLING 2x2sub	
307K	CONV 11x11/ReLU 256fm	223M
	MAX POOL 2x2sub	
	LOCAL CONTRAST NORM	
35K	CONV 11x11/ReLU 96fm	106M

Size



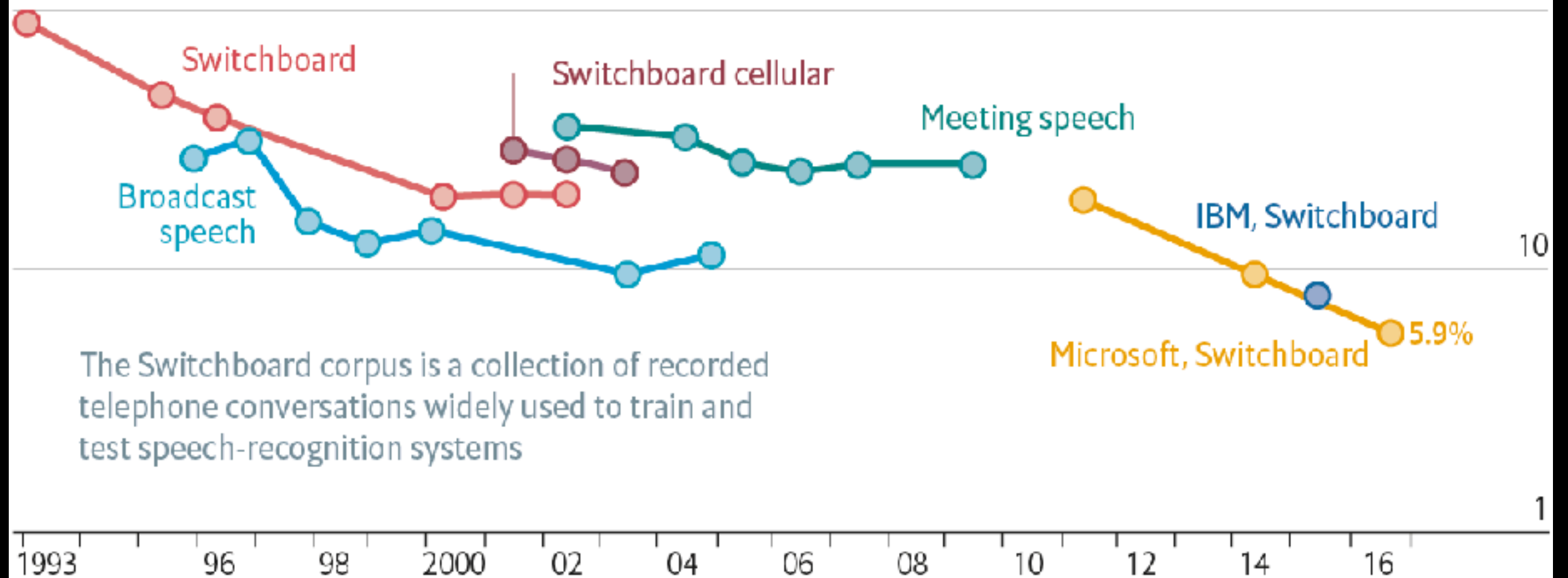
Reconocimiento de Voz

Loud and clear

Speech-recognition word-error rate, selected benchmarks, %

Log scale

100



The Switchboard corpus is a collection of recorded telephone conversations widely used to train and test speech-recognition systems

Sources: Microsoft; research papers

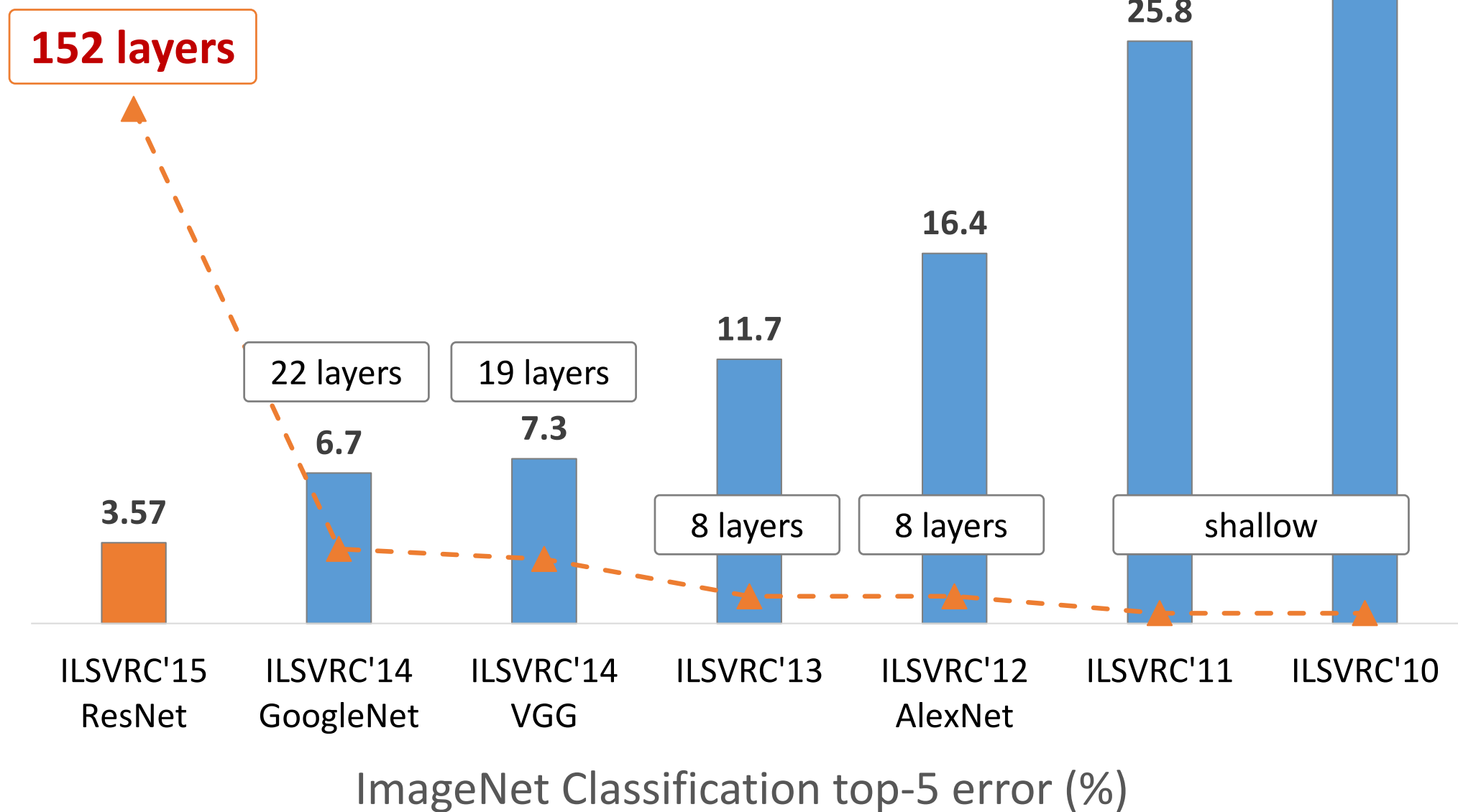
Reconocimiento de Voz



Visión por Computador

Microsoft
Research

Revolution of Depth



Detección de objetos



<http://silverpond.com.au/object-detector>

Detección de objetos



<http://silverpond.com.au/object-detector>

Image Captioning

I think it's a group of people sitting at a park.

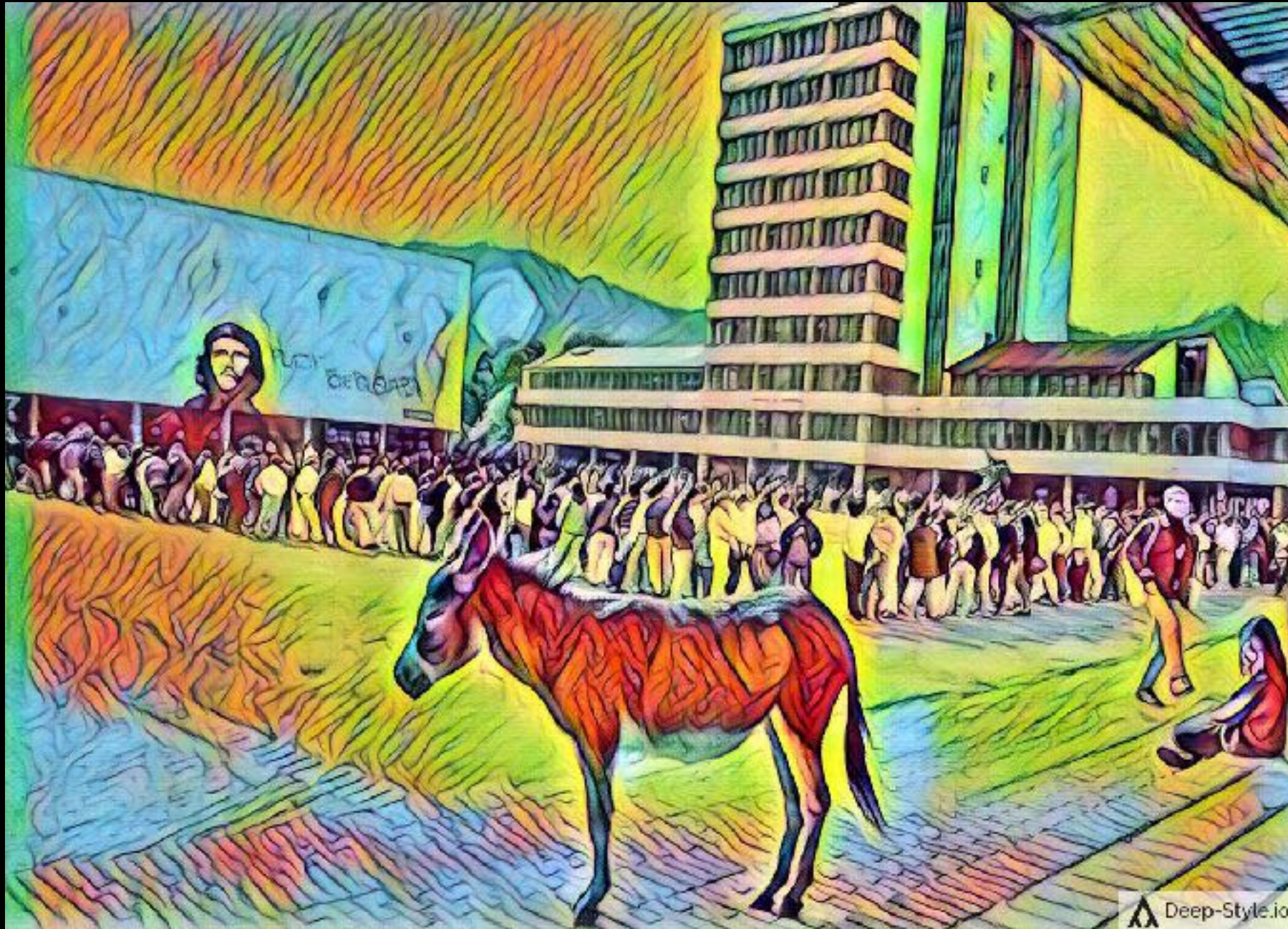


Image Captioning

I think it's a horse standing in front of a building and he seems



Transferencia de estilo

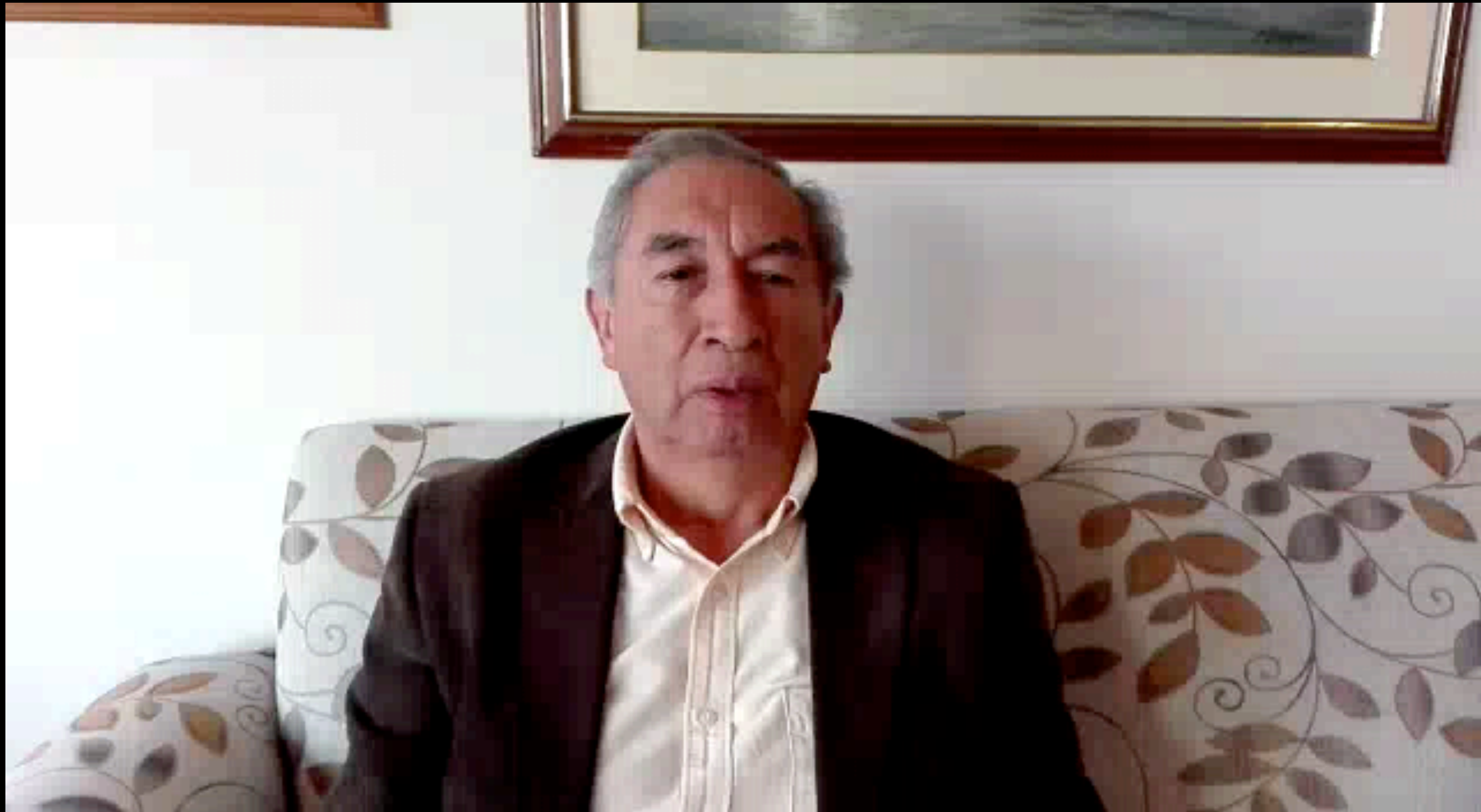




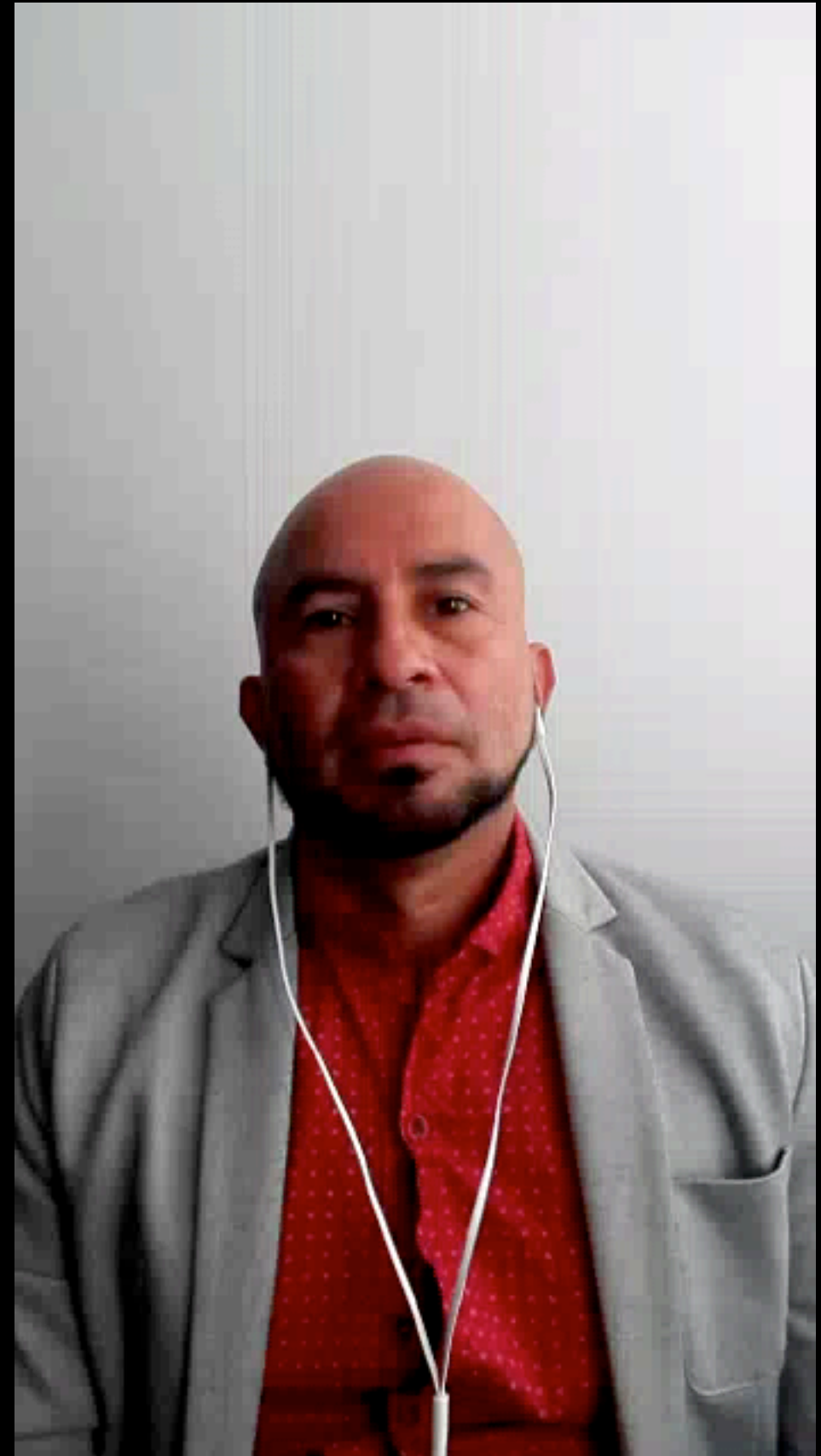
30 años de historia de IA en la UN



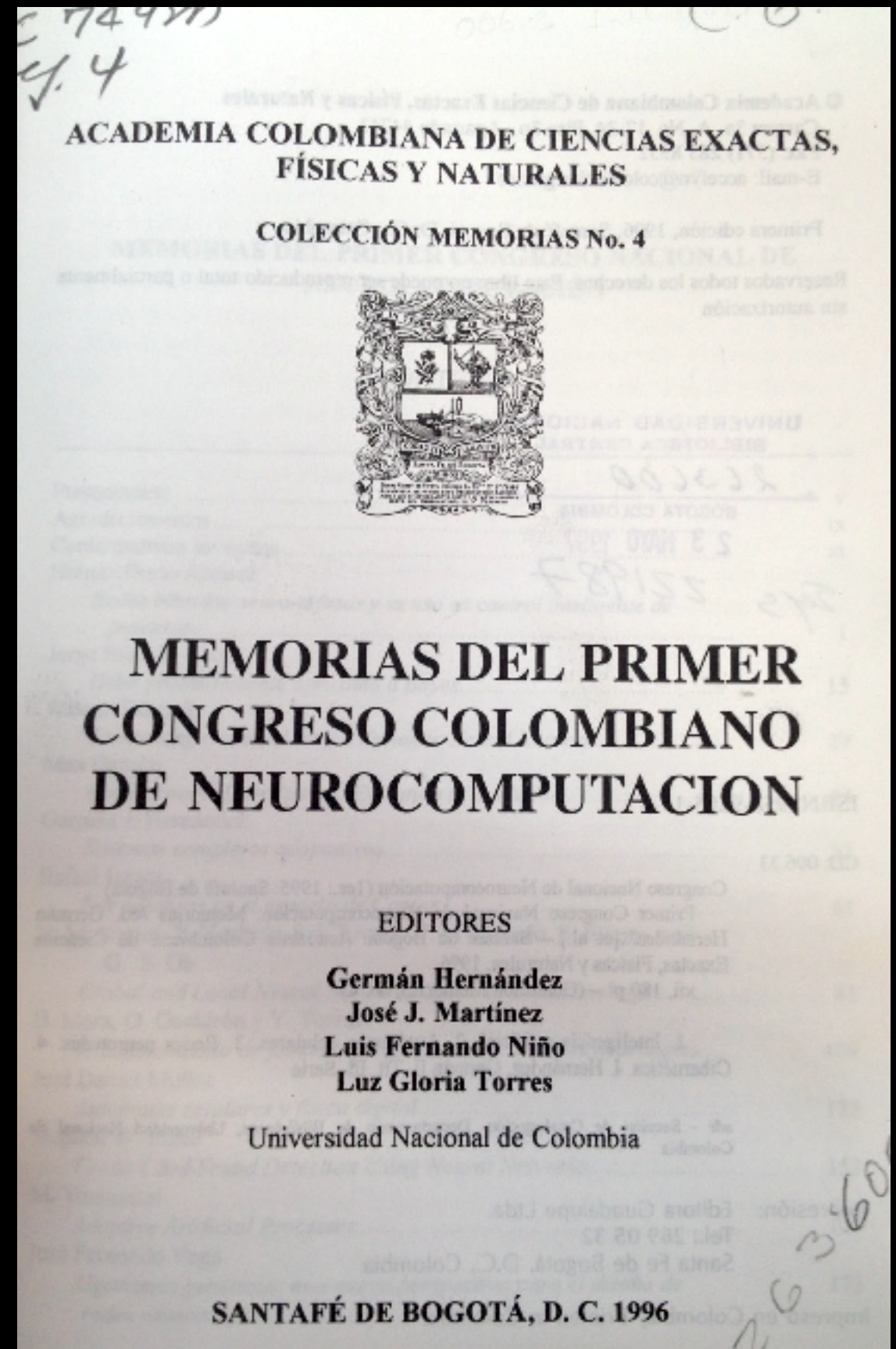
Prof. J.J. Martínez



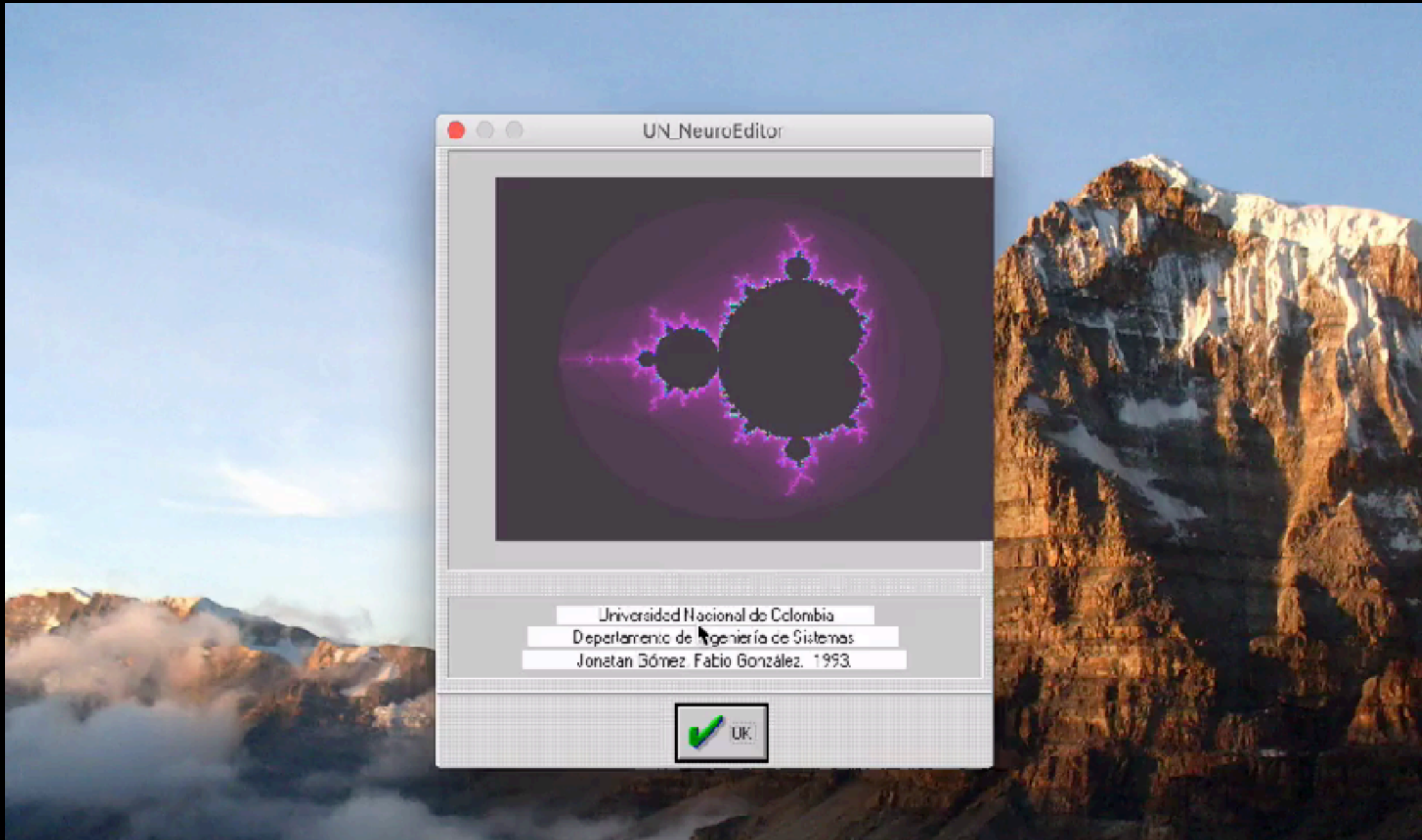
Prof. Luis F. Niño



Primer Congreso Colombiano de Neurocomputación (1996)



UN Neuro (1993)





- ***Sistemas computacionales inspirados en la naturaleza***
- ***Aplicaciones de Sistemas Inteligentes***
- ***Plataformas computacionales para la implementación de sistemas inteligentes***



Luis Fernando Niño V., Ph. D.
lfninov@unal.edu.co
Director



Grupo de Algoritmos y Combinatoria (ALGOS)



- Areas de interés:
 - Trading Algorítmico, Finanzas Computacionales y Fintech
- Miembros:
 - Andrés Arevalo (Estudiante PhD)
 - Diego León (Estudiante PhD)
 - Jaime Niño (Estudiante PhD)
 - Javier Sandoval (PhD, Docente Externado)
- Director:
 - Germán Hernández (PhD, Profesor UNAL)
- Temas de investigación:
 - Machine Learning, Bioinformatics, Deep Learning
- Algunas publicaciones:
 1. Market Trend Visual Bag of Words Informative Patterns in Limit Order Books
 2. High Frequency Trading Strategy based on Deep Neural Networks
 3. Detecting Informative Patterns in Financial Market Trends based on Visual Analysis
 4. Price direction prediction on high frequency data using Deep Belief Networks
 5. Complex Network Approach to Identify Potential Financial Scandals the Colombian Market Case
 6. Clustering algorithms for Risk-Adjusted Portfolio Construction

Análisis de redes sociales

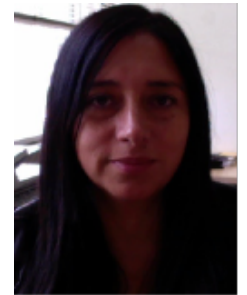
Análisis de opinión: elecciones presidenciales, marcas.
Detección perfiles falsos en twitter

Detección de comunidades



Algoritmos de agrupación

Bioinspirados, algoritmos genéticos, gravitación
Escalables y dinámicos para manejo de Big Data



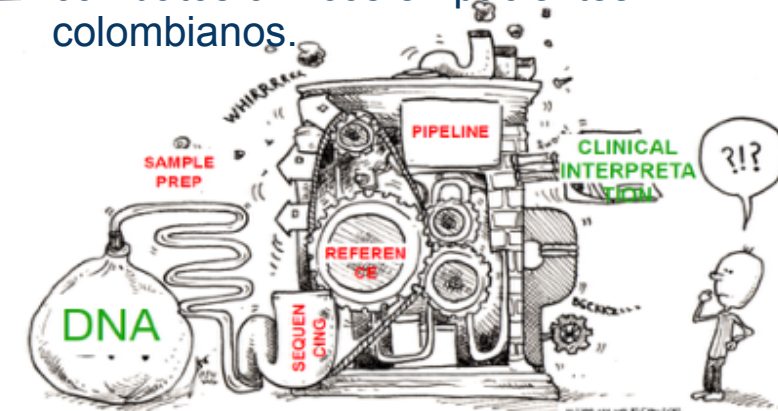
Educación

Predicción de deserción de estudiantes. Influencia de bienestar en la deserción en la U. Nacional.



Bioinformática

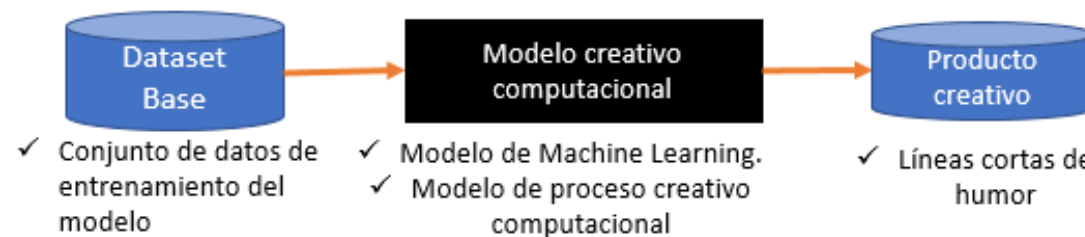
“DNA Codeword Design” usando algoritmos genéticos.
Identificación de variantes y asociación con datos clínicos en pacientes colombianos.



Aprendizaje de Máquina Estadística
Inteligencia Artificial
Big Data

Minería de texto

Procesamiento de Lenguaje Natural



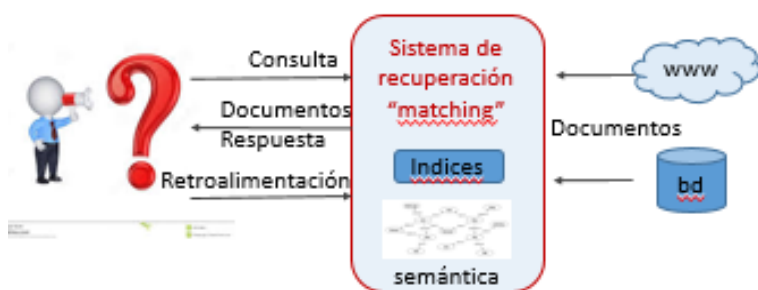
✓ Conjunto de datos de entrenamiento del modelo

✓ Modelo de Machine Learning.
✓ Modelo de proceso creativo computacional

✓ Líneas cortas de humor

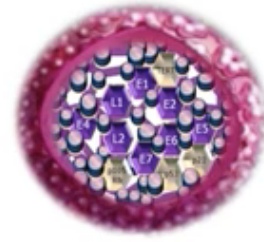
Aprendizaje profundo para generación de textos de humor

Sistemas de Recuperación de Información



Minería web

Metabuscadores Web, SRI para bibliotecas, reformulación de consultas, perfilamiento de usuarios



Artificial Intelligence in Medicine
 Contents lists available at ScienceDirect
 ELSEVIER
 A growth model of human papillomavirus type 16 designed from cellular automata and agent-based models
 María Elena Escobar Ospina, Jonatan Gómez Perdomo*
 Department of Engineering - Systems and Computing, Universidad Nacional, Avenida Central 39 #1-45, Bogotá, Colombia

Interface Info Code
 normal speed
 view updates on ticks
 ticks: 177

Initial settings
 Number of people: 200
 Number of taxis: 25
 Number of taxis: 25

Assignment policies
 People policies
 choosing_customer_policy_code: Bfo
 choosing_driver_policy_code: randomly
 radius_driver_policy_uber: 10
 radius_driver_policy_taxi: 10

Uber policies
 choosing_driver_policy_code: randomly
 radius_driver_policy_uber: 10

Taxi policies
 choosing_driver_policy_code: closest
 radius_driver_policy_taxi: 10

Count
 26.4
 0
 ticks: 184
 ubers being used
 taxis being used

People
 1
 0
 ticks: 184
 waiting
 being transported

uber vs taxis
 1000
 0
 ticks: 184

IFunco: An Application that can be used for Teaching and Learning Functional Programming and Inducing Functional Programs

Options
 Module for Interpreting Module for Inducing Module for Diagnosing

Examples Clear

Console of Induction Console of Programs Induced Console of Results Console of Generalizations Console of Global Tests Console of Statistic Tests

Evolutionary Algorithm
 Hybrid Adaptive Evolutionary Algorithm (hata) Classic Genetic Programming Algorithm (GP)

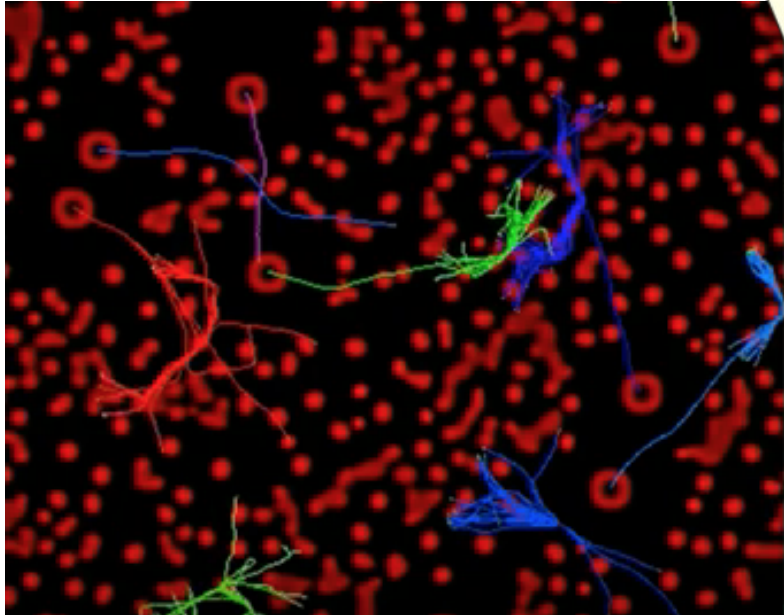
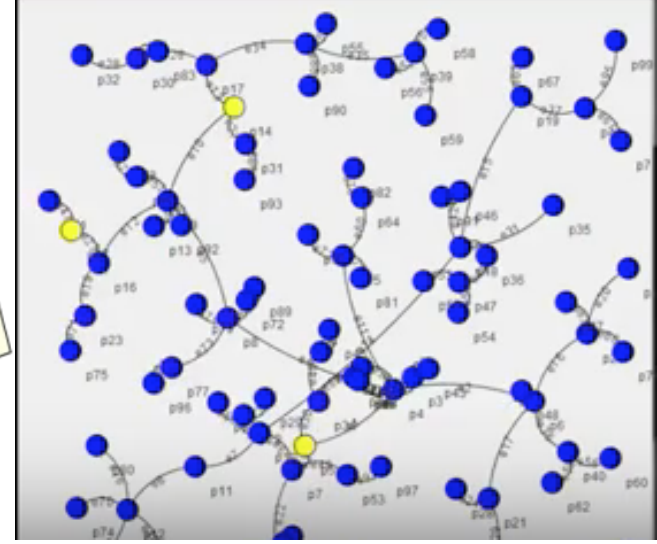
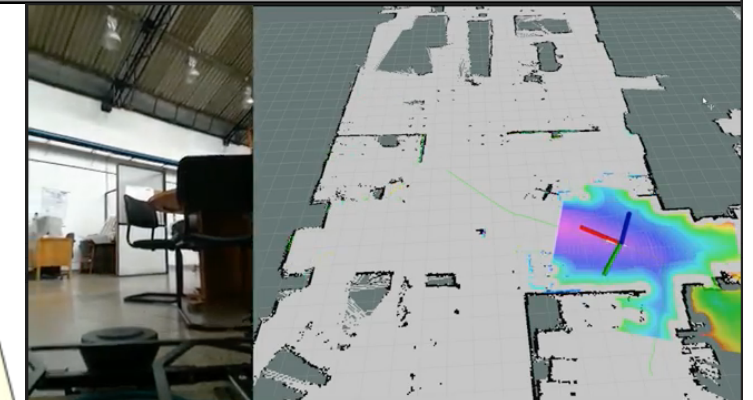
Positive Basic Examples (E⁺)
 1. reverse([1]) = [1]
 2. reverse([a]) = [a]

Positive Extra Examples (E⁺)
 1. reverse([x,y]) = [y,x]
 2. reverse([x,y,z]) = [z,y,x]
 3. reverse([w,x,y,z]) = [z,y,x,w]
 4. reverse([0,...,0]) = [0,...,0]

Basic Equations (E⁰)
 1.

Negative Examples (E⁻)
 1.

Background knowledge (BKG)
 1. append([1],A) = A
 2. append([A]B,C) = [A]append(B,C)



Simulation 0.0 (ticks: 10.0) Real elapsed time: 0.000s Simulation elapsed time: 5.6s
 Tick: 501 Real elapsed time: 0.000s Simulation elapsed time: 5.6s
 Simulated interval (Action / Tick)

A 3D Head-Direction Cells Model Based on Bat Echolocation (Rueda and Gomez)

Brain monitor
 Left Ear Right Ear
 BHC BHC LSO
 AN AN DCN

Jonatan Gómez, Ph. D.
jgomezpe@unal.edu.co
 Grupo de Investigación en Vida Artificial

Problems

Multimodal learning
Large scale learning
Representation learning

Applications

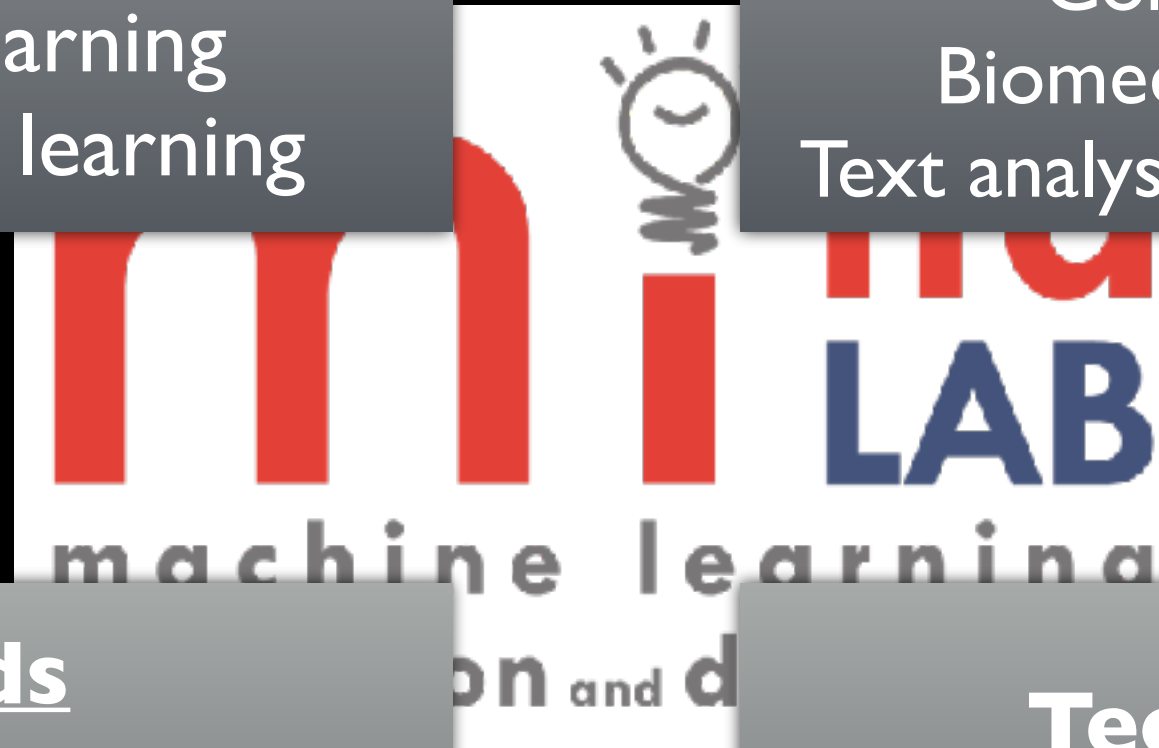
Information retrieval
Computer vision
Biomedical information
Text analysis and understanding

Methods

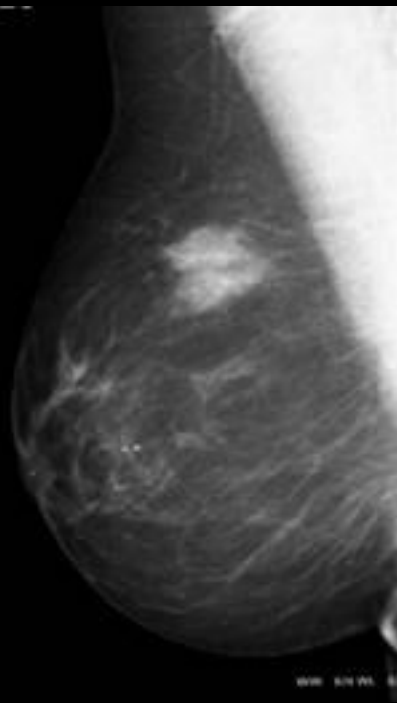
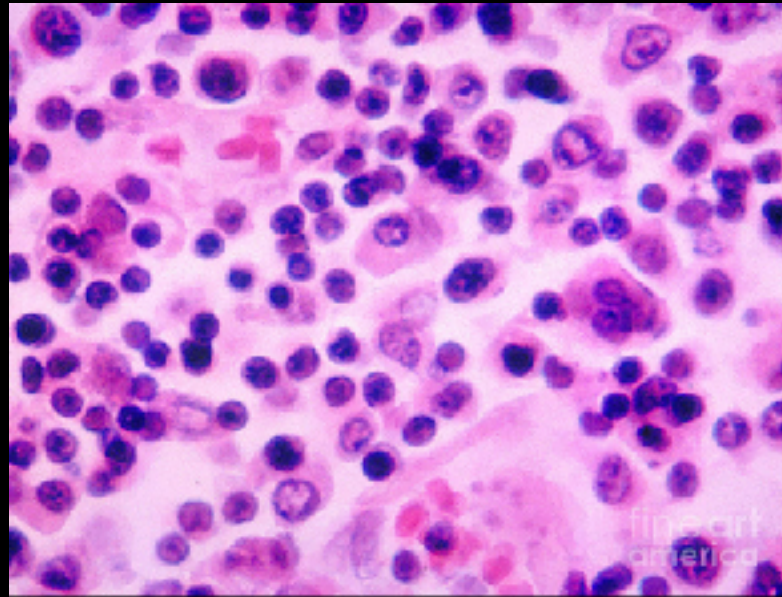
Kernel methods
Matrix factorization
Deep learning

Technologies

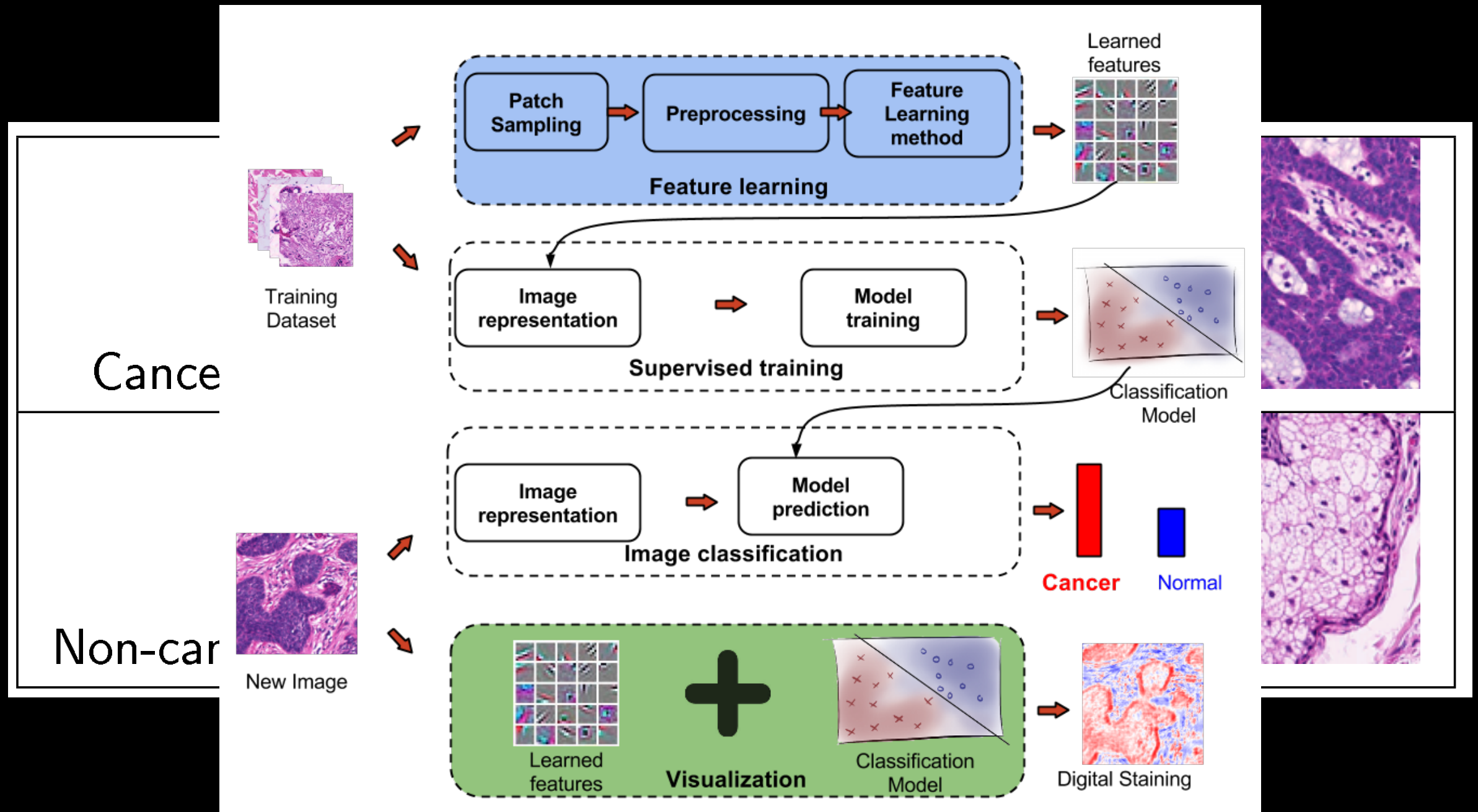
Distributed computing
GPGPU



Análisis de Imágenes Médicas



Análisis de Imágenes Médicas



Detección Eficiente de Tumores

(12) **United States Patent**
Madabhushi et al.

(10) **Patent No.:** **US 9,430,829 B2**
(45) **Date of Patent:** **Aug. 30, 2016**

(54) **AUTOMATIC DETECTION OF MITOSIS USING HANDCRAFTED AND CONVOLUTIONAL NEURAL NETWORK FEATURES**

(58) **Field of Classification Search**
None
See application file for complete search history.

(71) Applicant: **Case Western Reserve University,**
Cleveland, OH (US)

(56) **References Cited**

U.S. PATENT DOCUMENTS

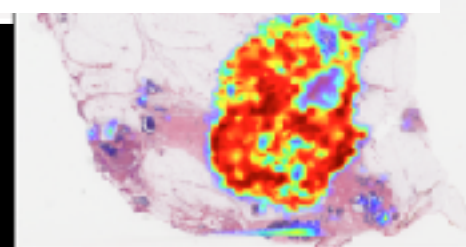
(72) Inventors: **Anant Madabhushi,** Beachwood, OH (US); **Haibo Wang,** Cleveland Heights, OH (US); **Angel Cruz-Roa,** Bogota (CO); **Fabio Gonzalez,** Bogota (CO)

2007/0112701	A1 *	5/2007	Chellapilla	G06K 9/6256 706/15
2007/0140556	A1 *	6/2007	Willamowski	G06K 9/0061 382/167
2010/0002920	A1 *	1/2010	Cosatto	G06K 9/00147 382/128
2010/0172568	A1 *	7/2010	Malon	G06K 9/00147 382/133
2014/0139625	A1 *	5/2014	Mathuis	G03H 1/0005 348/40
2014/0314292	A1 *	10/2014	Kamen	A61B 6/463 382/131

(73) Assignee: **Case Western Reserve University,**
Cleveland, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

* cited by examiner





EFECTOSTUDIOS



SURVIVAL EVOLVED



EFECTOSTUDIOS

m  **nd**
LAB
machine learning
perception and discovery



DECOHERENCE

THE END

Gracias!

fagonzalezo@unal.edu.co

<http://mindlaboratory.org>

m i n d
LAB
machine learning
perception and discovery
περσεψηση και ανακρυψη

