



MODELOS DE DEEP LEARNING PARA DADOS DE IMAGENS NA SAÚDE

Ricardo Rocha

QUEM SOU EU

- **Bacharel** em Matemática pela UNESP Rio Claro,
- **Mestre e Doutor** em Estatística pela UFSCAR São Carlos,
- **Docente IME/UFBA**, afastado no momento,
- **Pesquisador** na área de Aprendizado de Máquina, Modelagem Preditiva e Análise de Sobrevivência,
- **Consultor** na área de Inteligência de Negócios, Machine Learning e Inteligência Artificial,
- **Professor e Coordenador** do MBA em Data Science FLAI FAMESP,
- **Cofundador da FLAI** – Inteligência Artificial, empresa voltada para educação moderna de profissionais de dados.



HOJE

1

**VISÃO COMPUTACIONAL E
IMAGENS DIGITAIS**

2

**AS REDES NEURAIS
CONVOLUCIONAIS**

3

**APLICAÇÕES NA
MEDICINA**



VISÃO COMPUTACIONAL E IMAGENS DIGITAIS

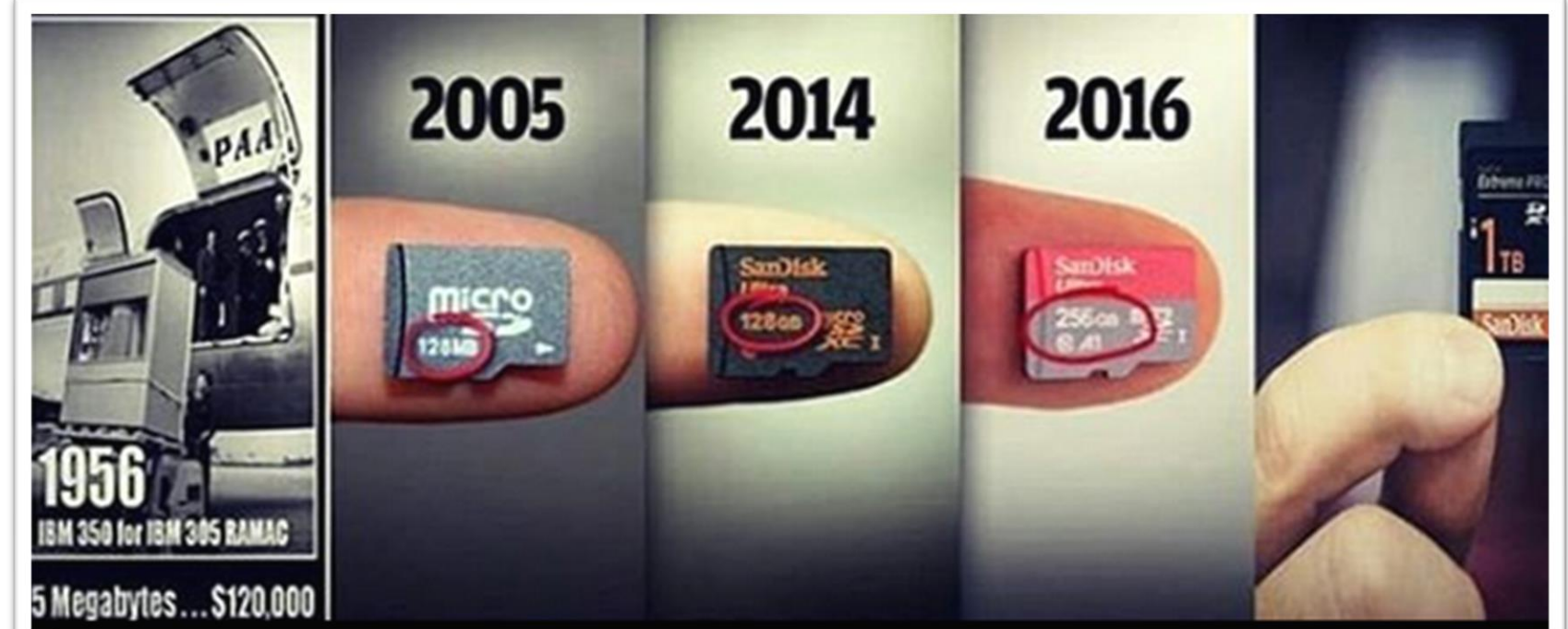
Regulating the internet giants

The world's most valuable resource is no longer oil, but data

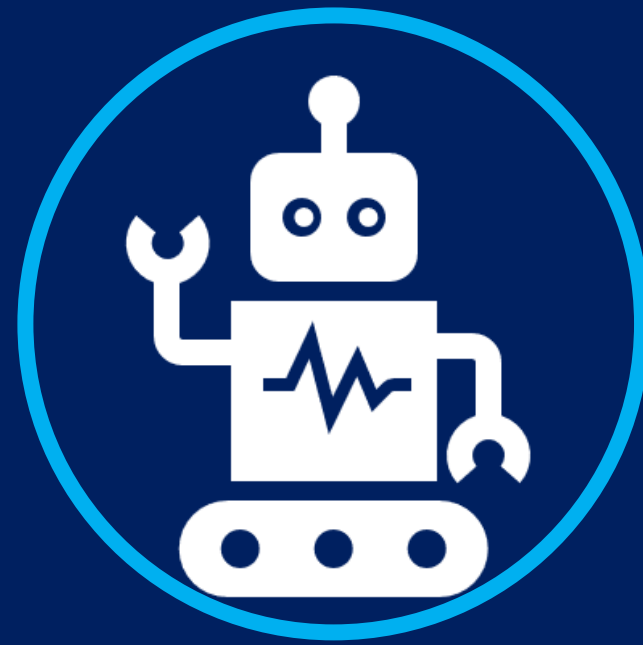
The data economy demands a new approach to antitrust rules



Print edition | Leaders >
May 6th 2017



BOOM DA INTELIGÊNCIAS ARTIFICIAIS



Inteligência
Artificial

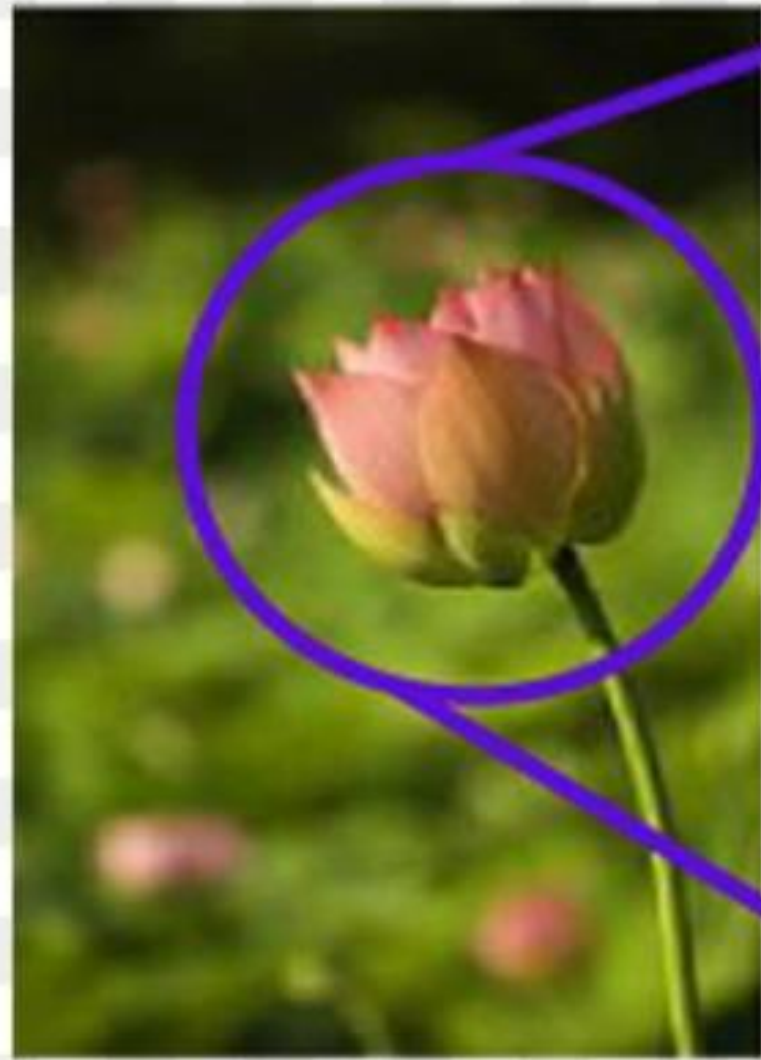


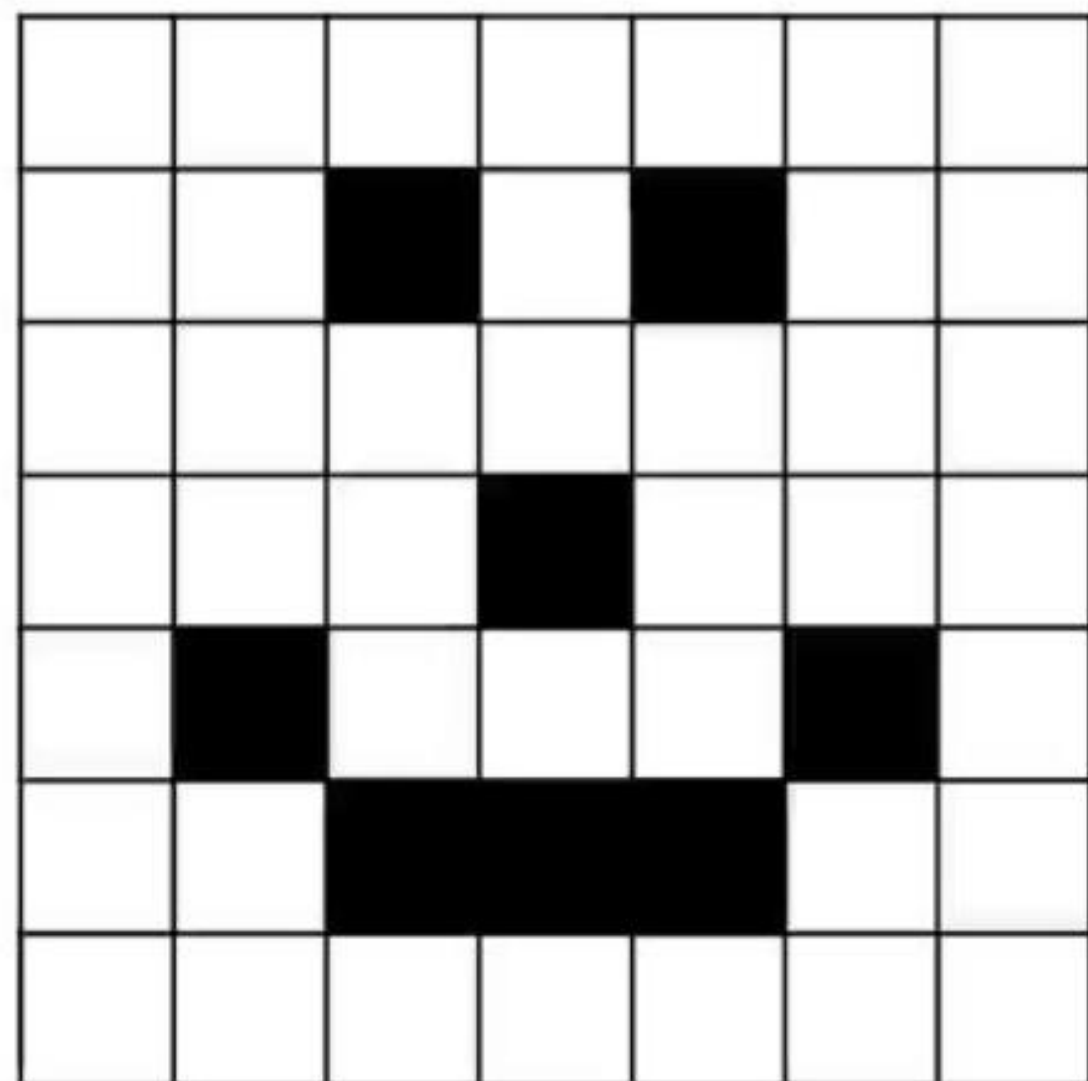
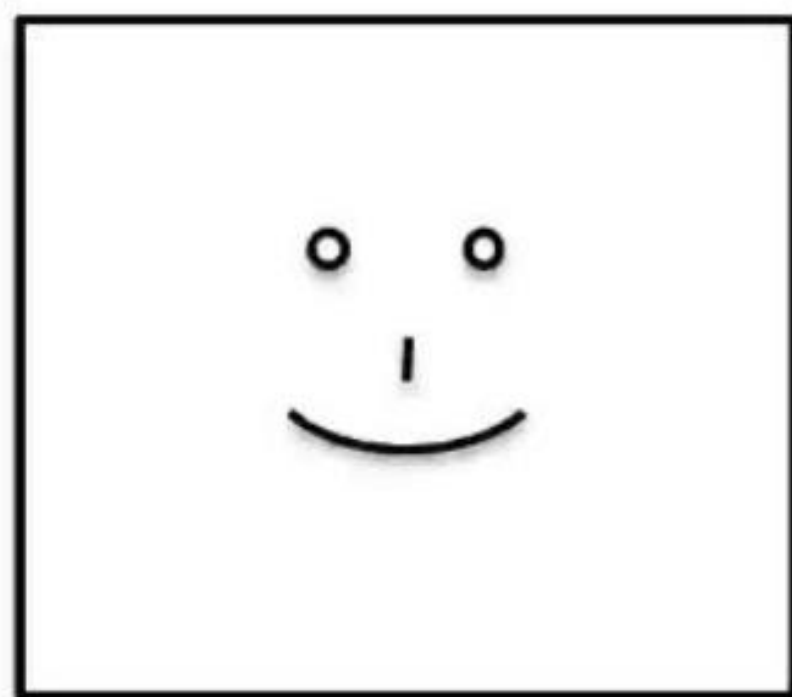
Machine
Learning



Deep
Learning



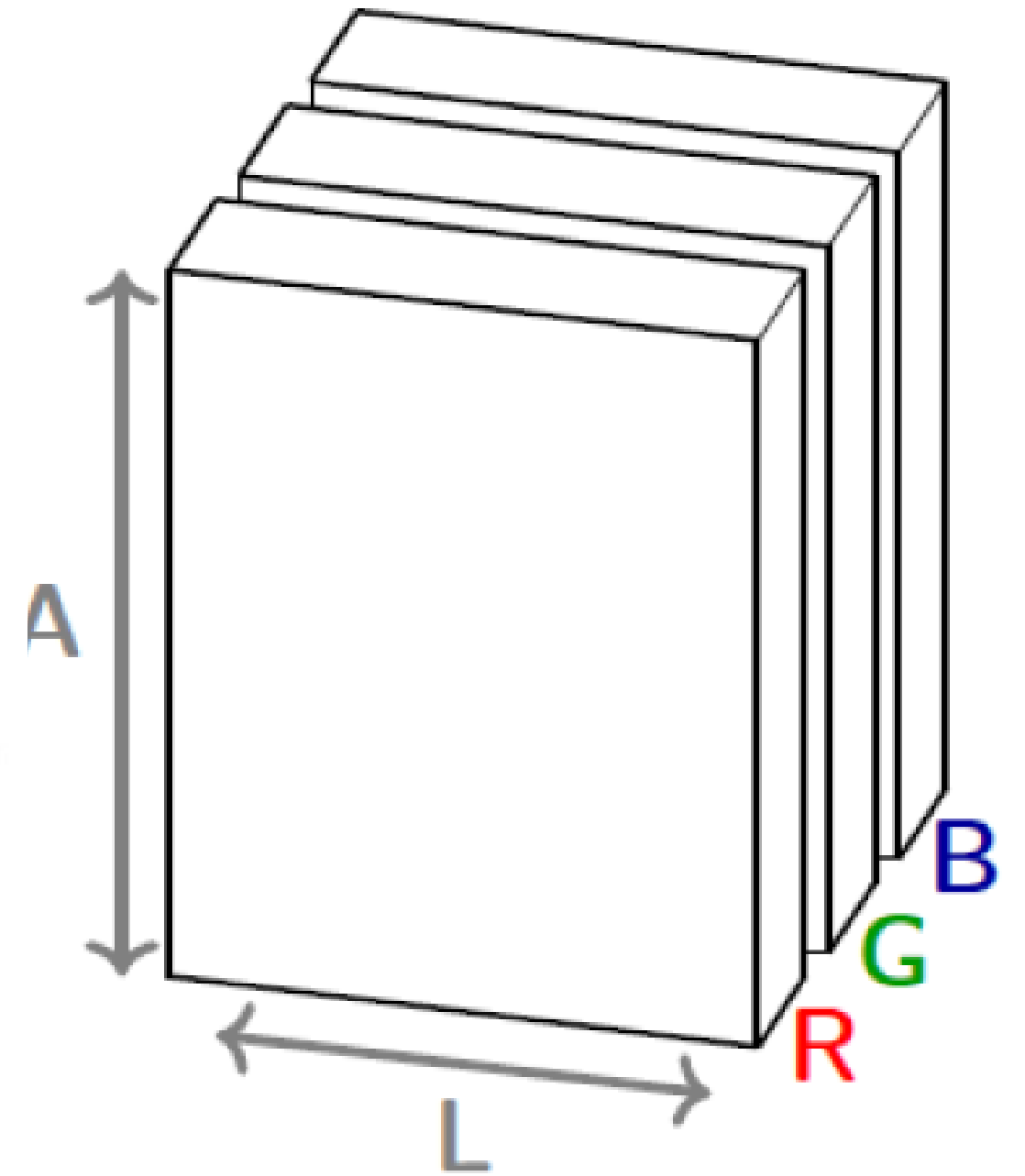
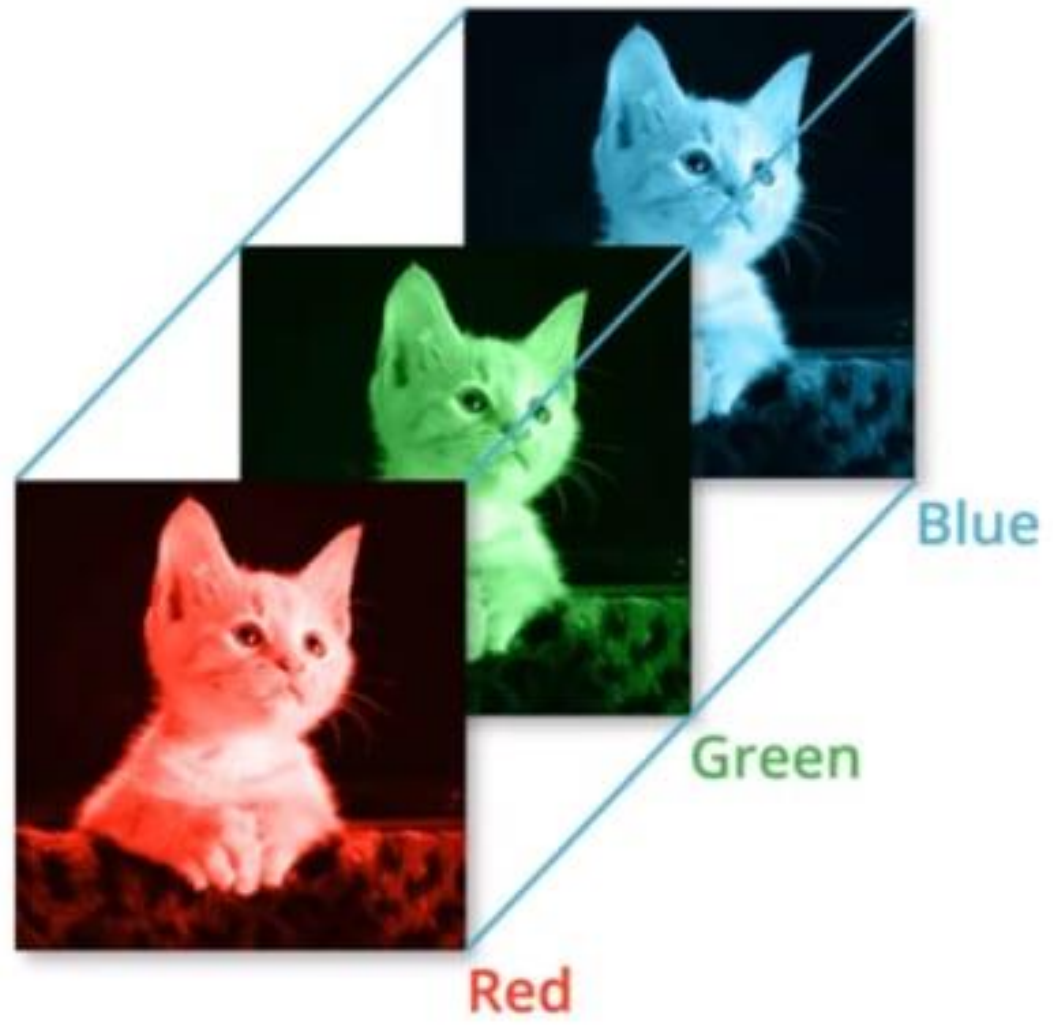




0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

RGB Image

5 x 5 x 3

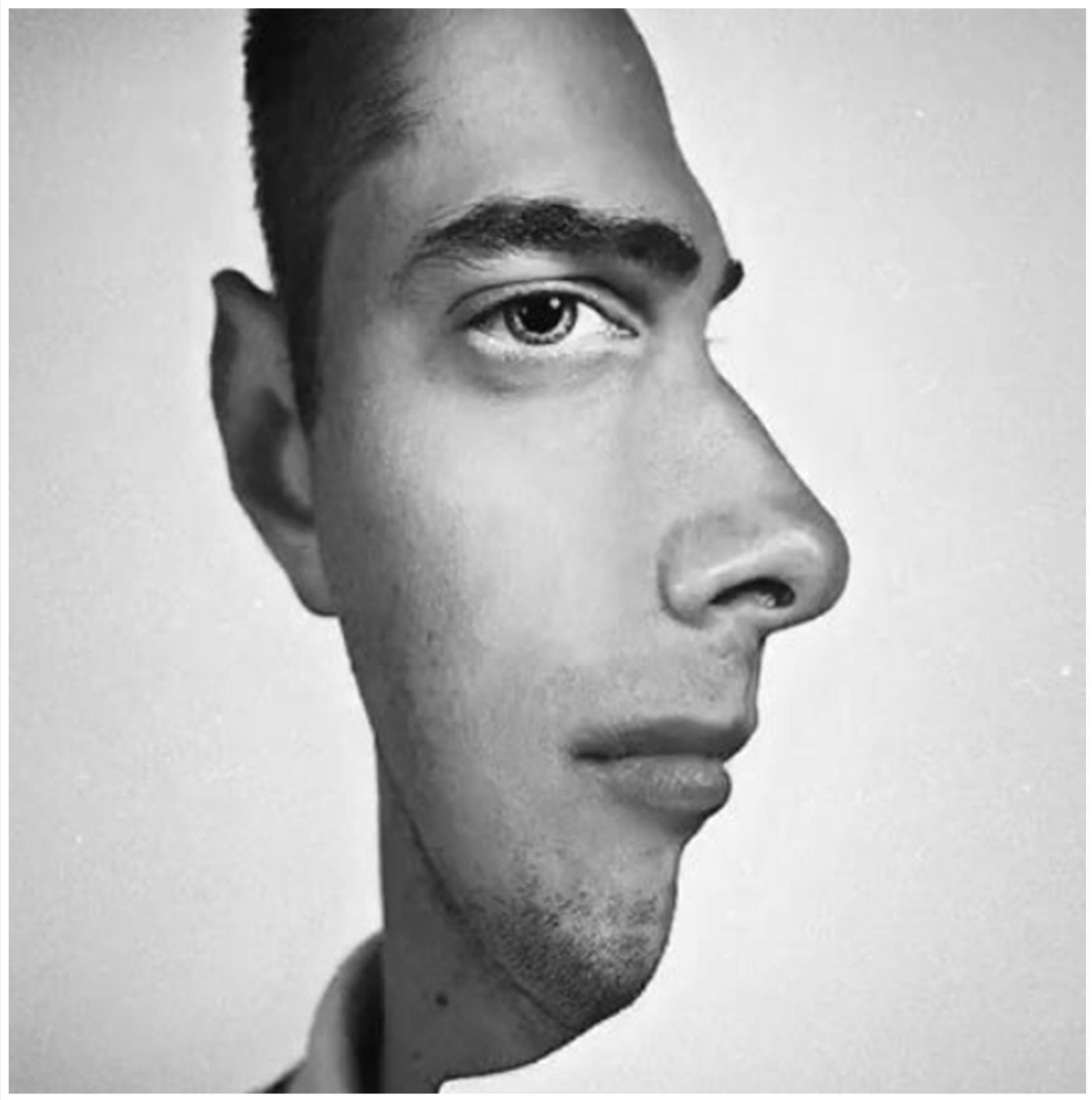


<http://setosa.io/ev/image-kernels/>

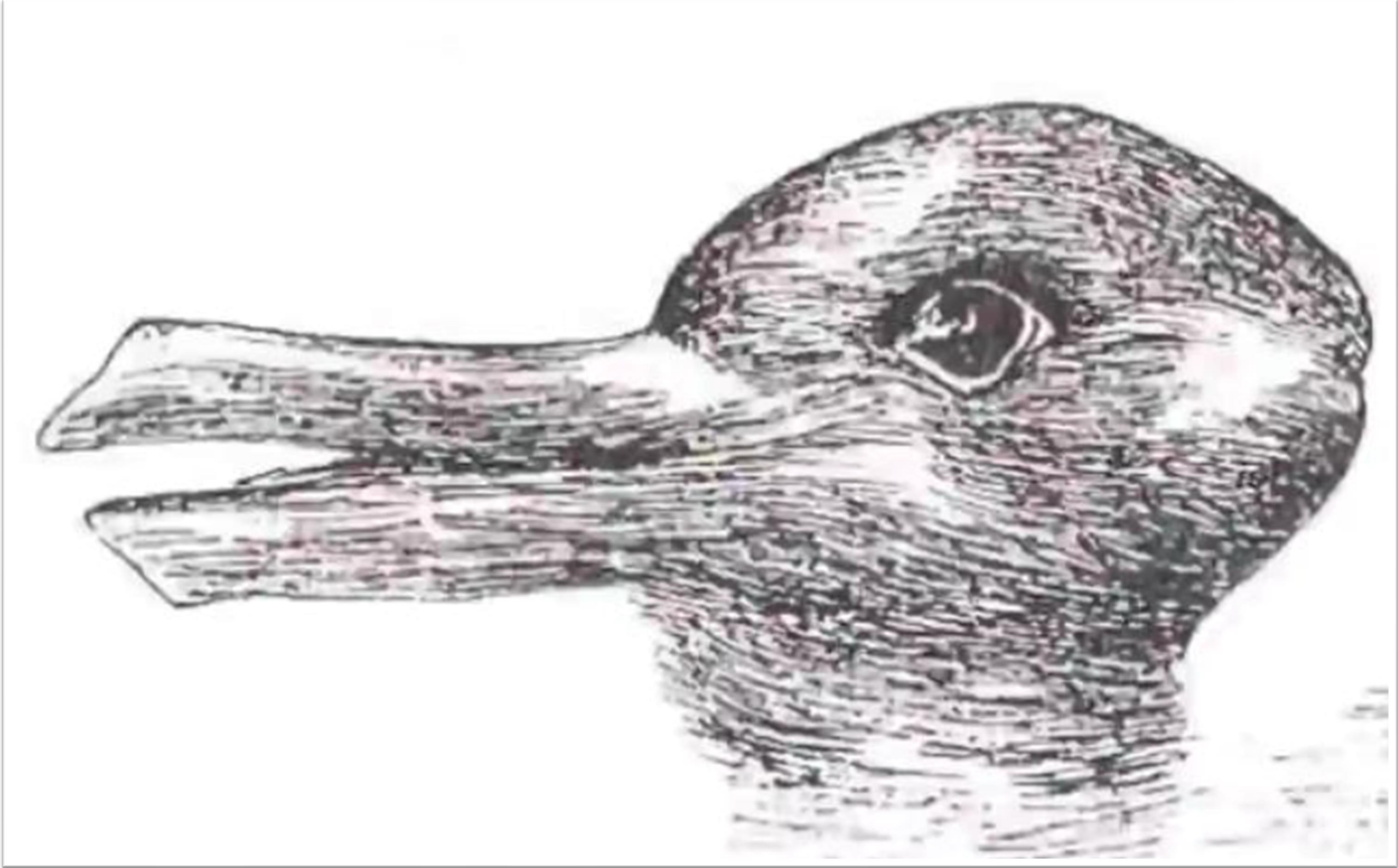
AS REDES NEURAIS

CONVOLUCIONAIS









Classification



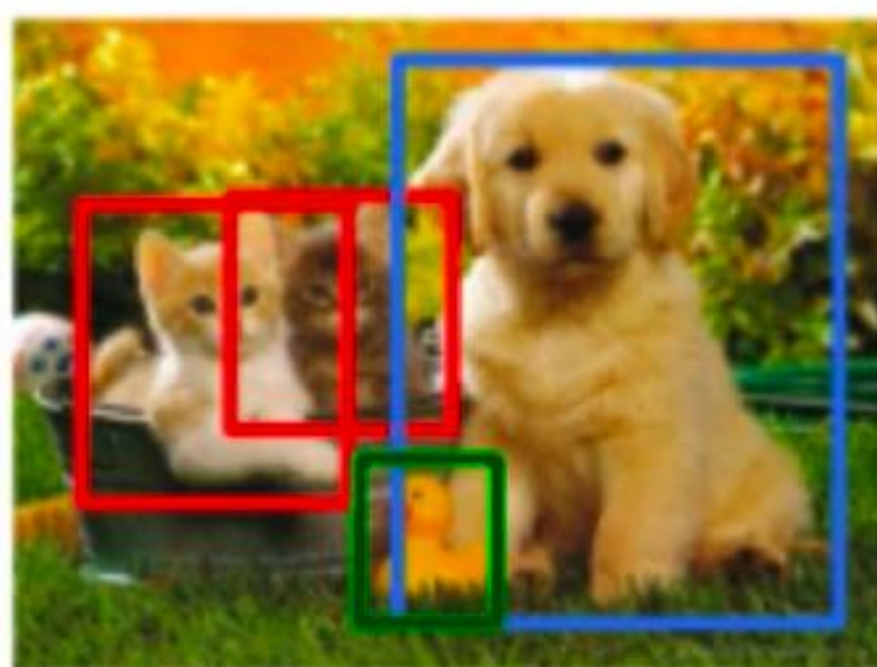
CAT

Classification + Localization



CAT

Object Detection



CAT, DOG, DUCK

Instance Segmentation



CAT, DOG, DUCK

Single object

Multiple objects

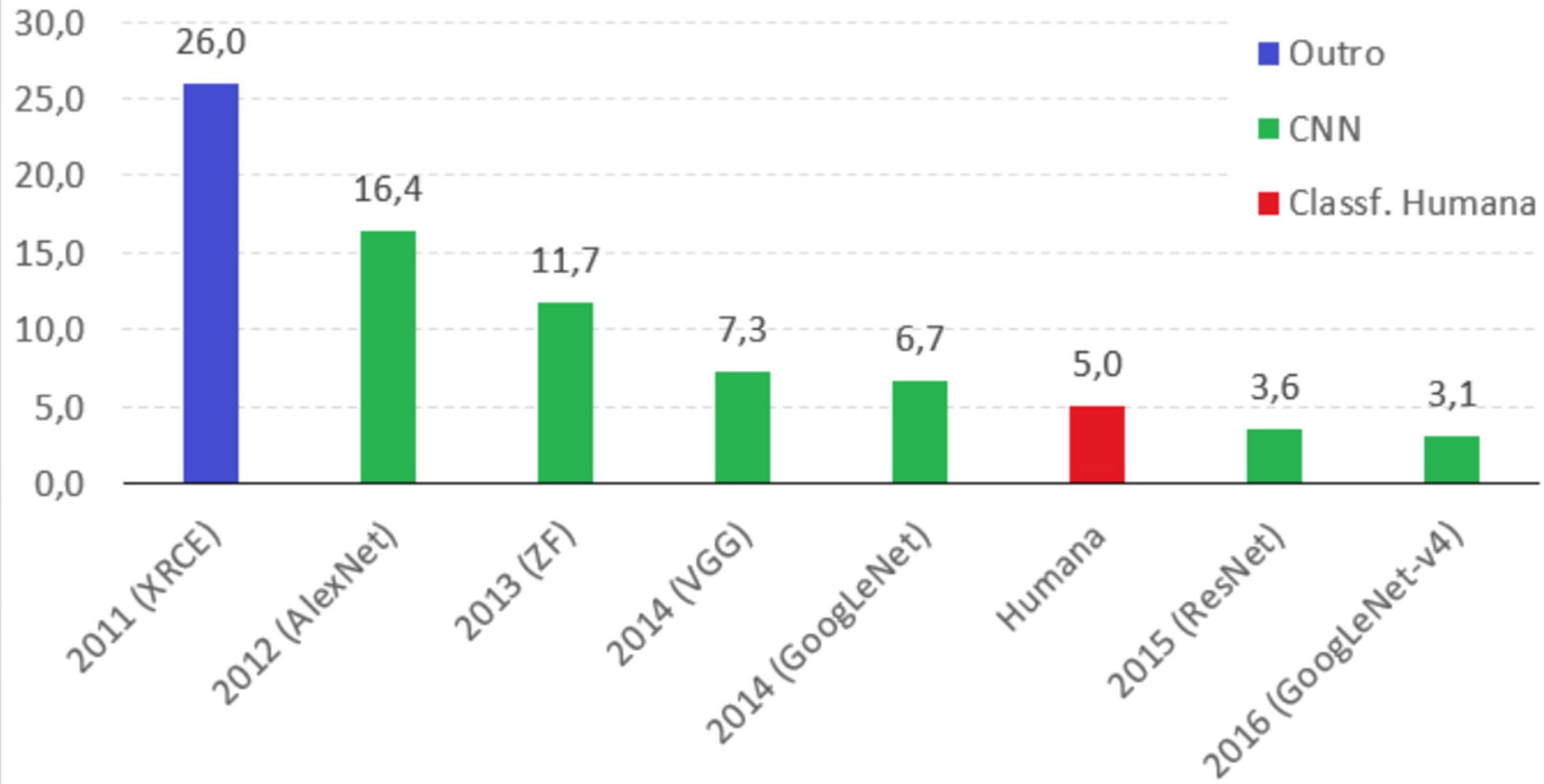


cheetah	
cheetah	
leopard	
snow leopard	
Egyptian cat	

bullet train	
bullet train	
passenger car	
subway train	
electric locomotive	

hand glass	
scissors	
hand glass	
frying pan	
stethoscope	

Classificação do top erro do ImageNet

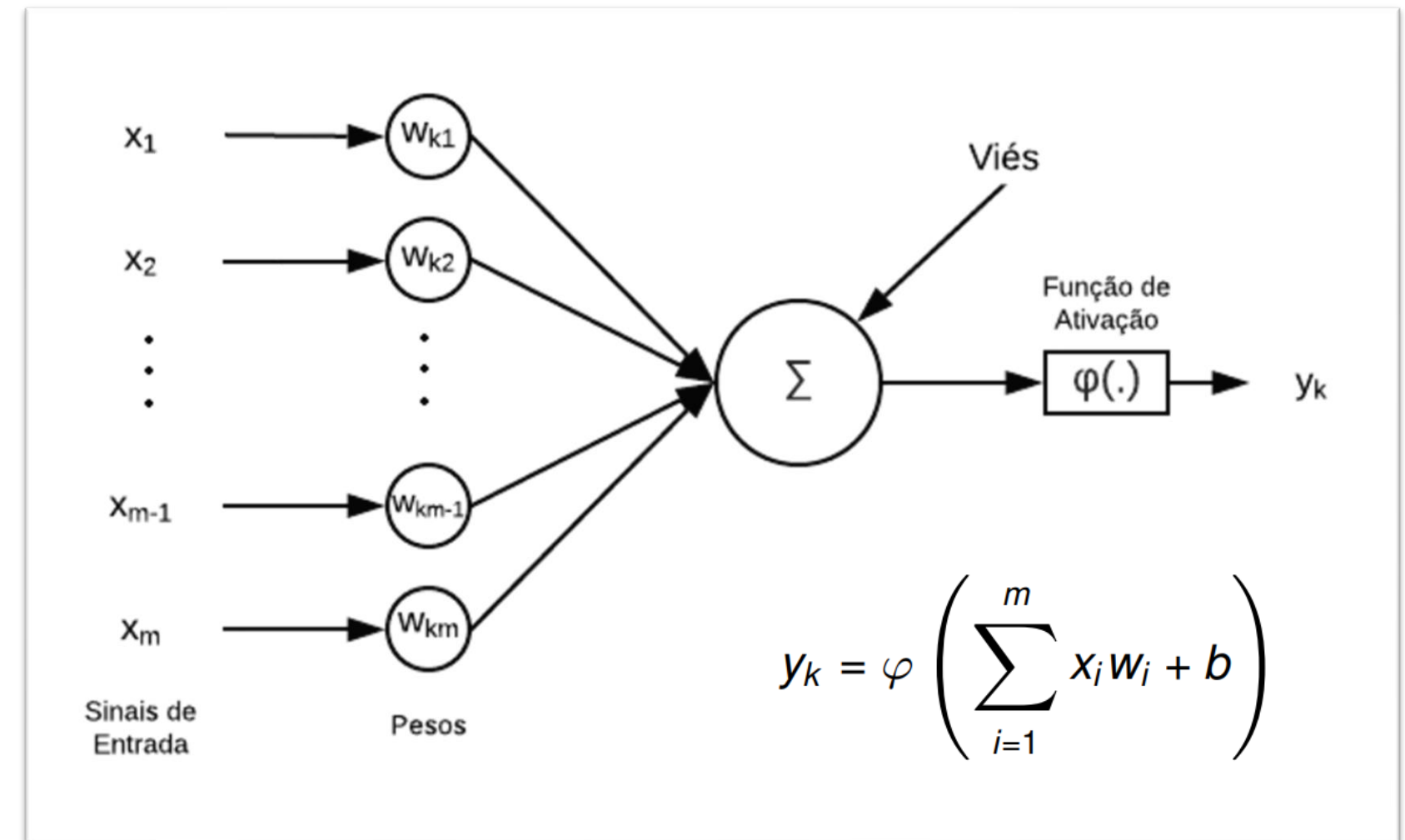
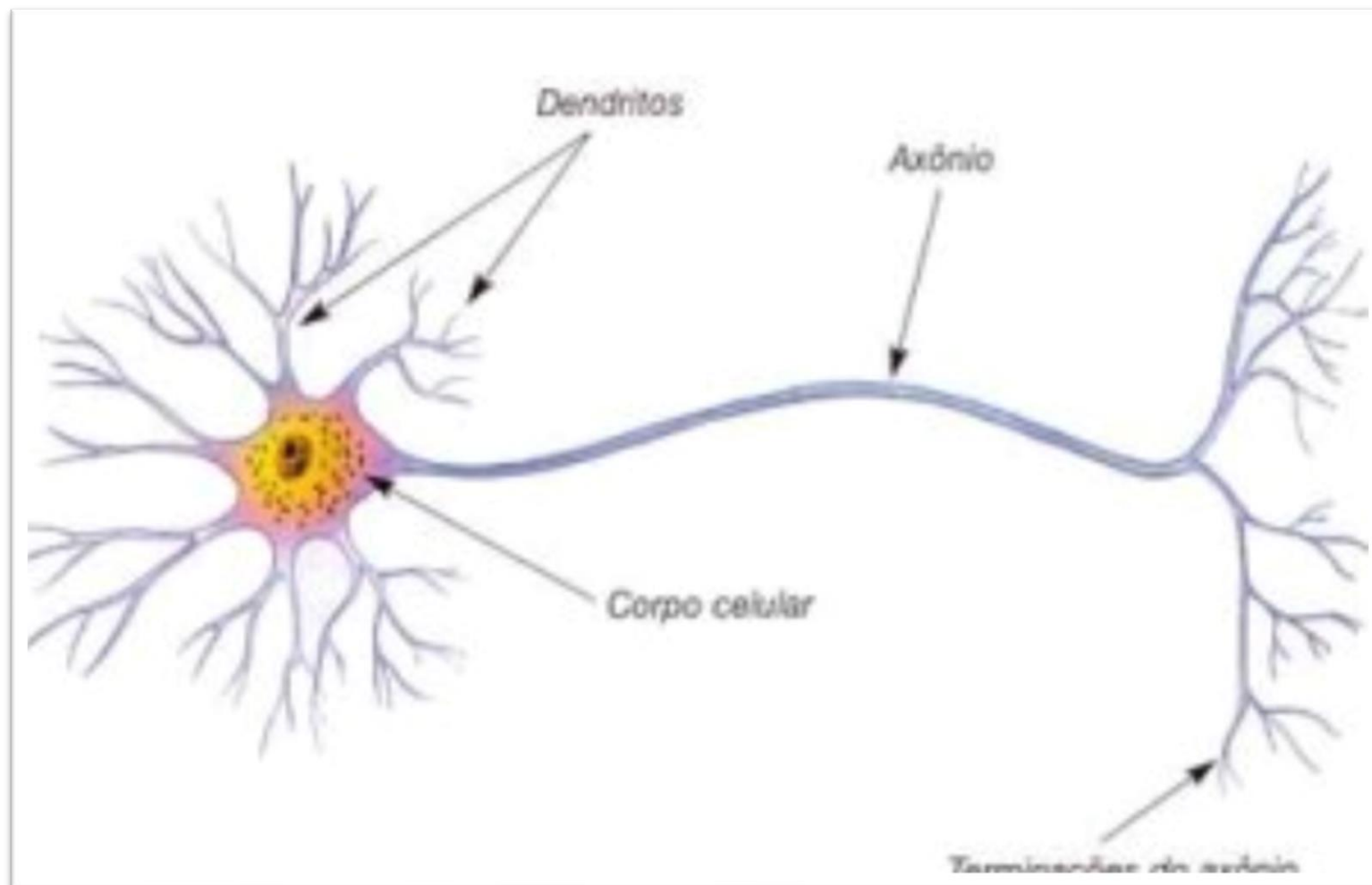




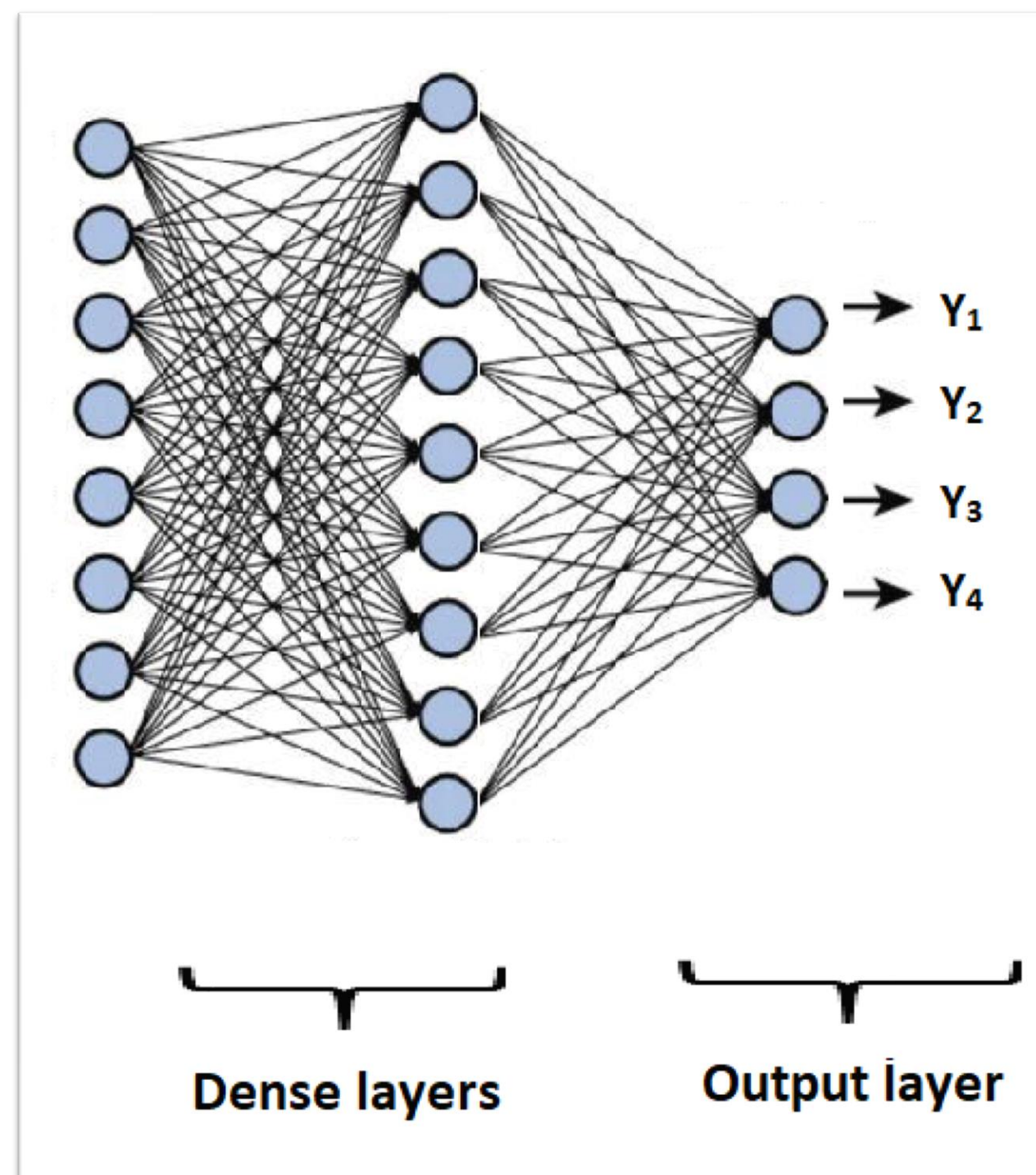




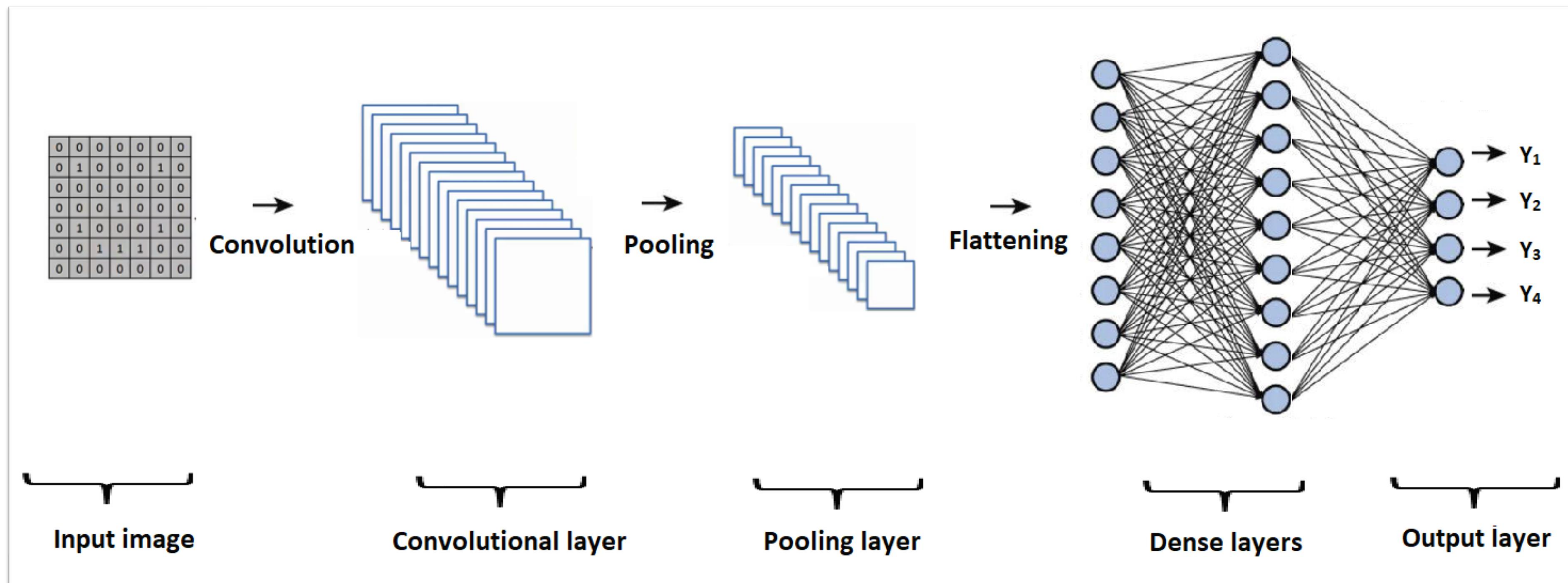
REPRESENTAÇÃO MATEMÁTICA



REDE NEURAL USUAL

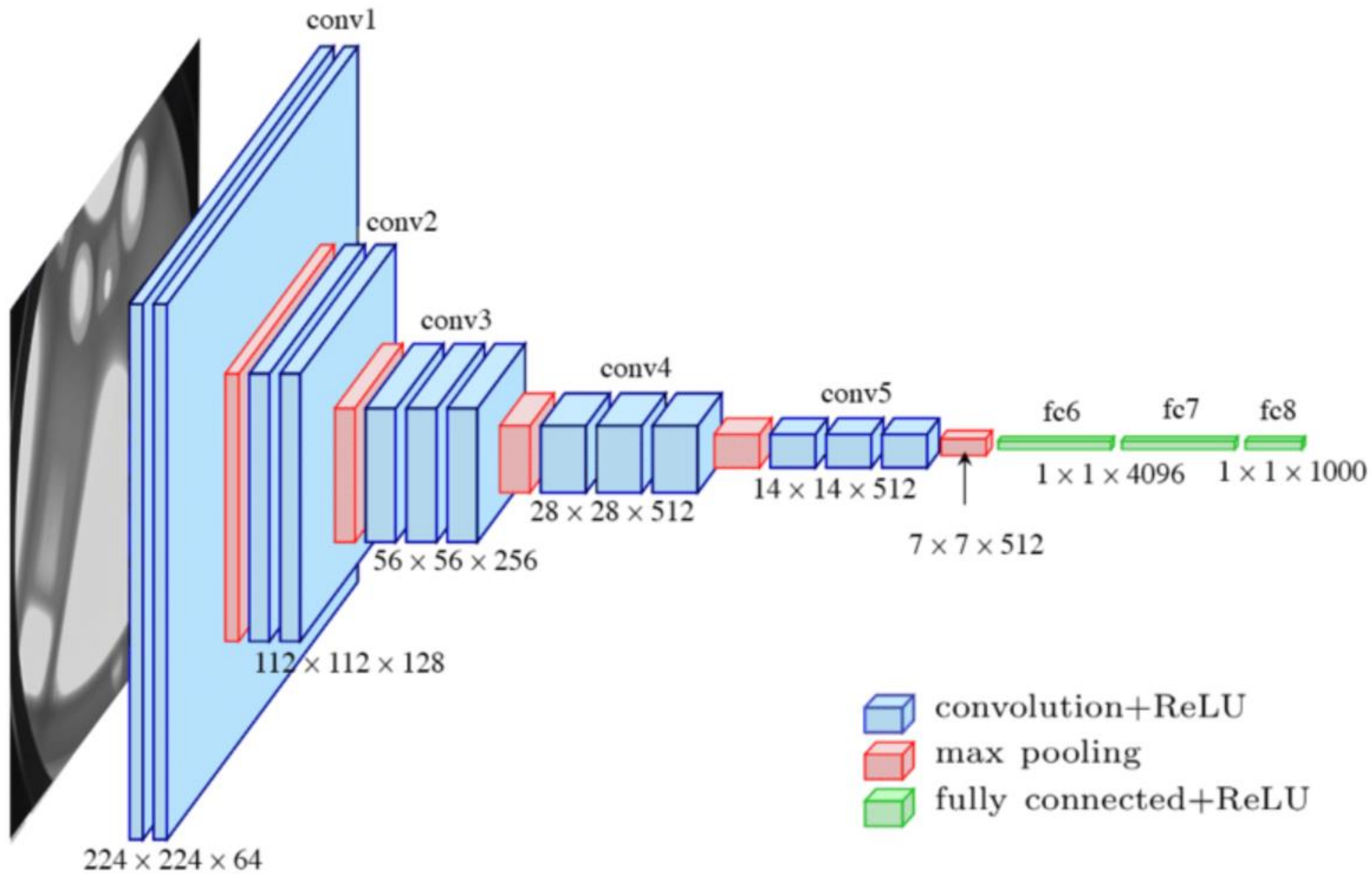


REDE NEURAL CONVOLUCIONAL





<https://www.youtube.com/watch?v=f0t-OCG79-U>





<https://quickdraw.withgoogle.com/>



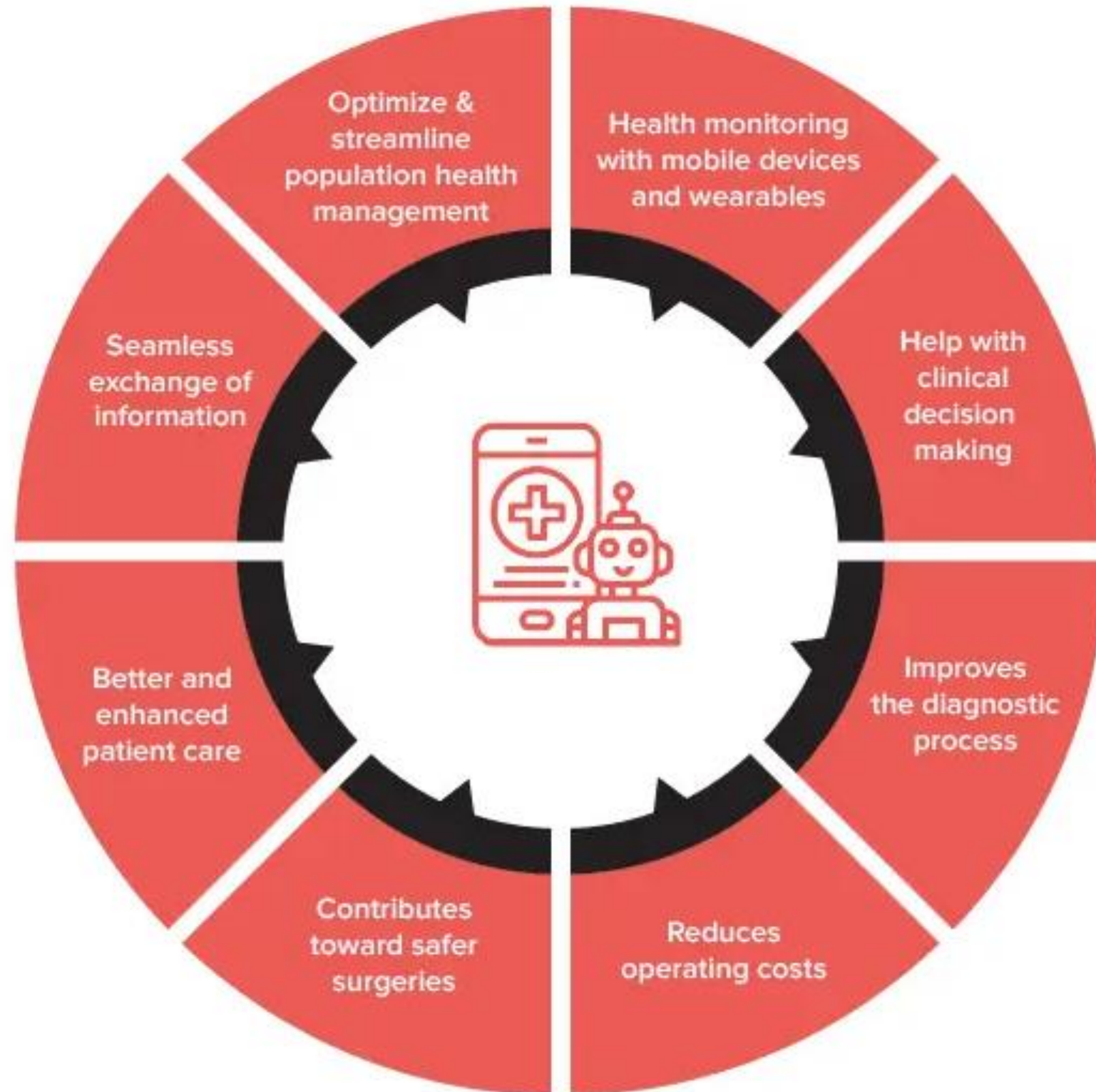
<https://teachablemachine.withgoogle.com/>



<https://www.youtube.com/watch?v=tlThdr305Qo> - "Full Self-Driving"

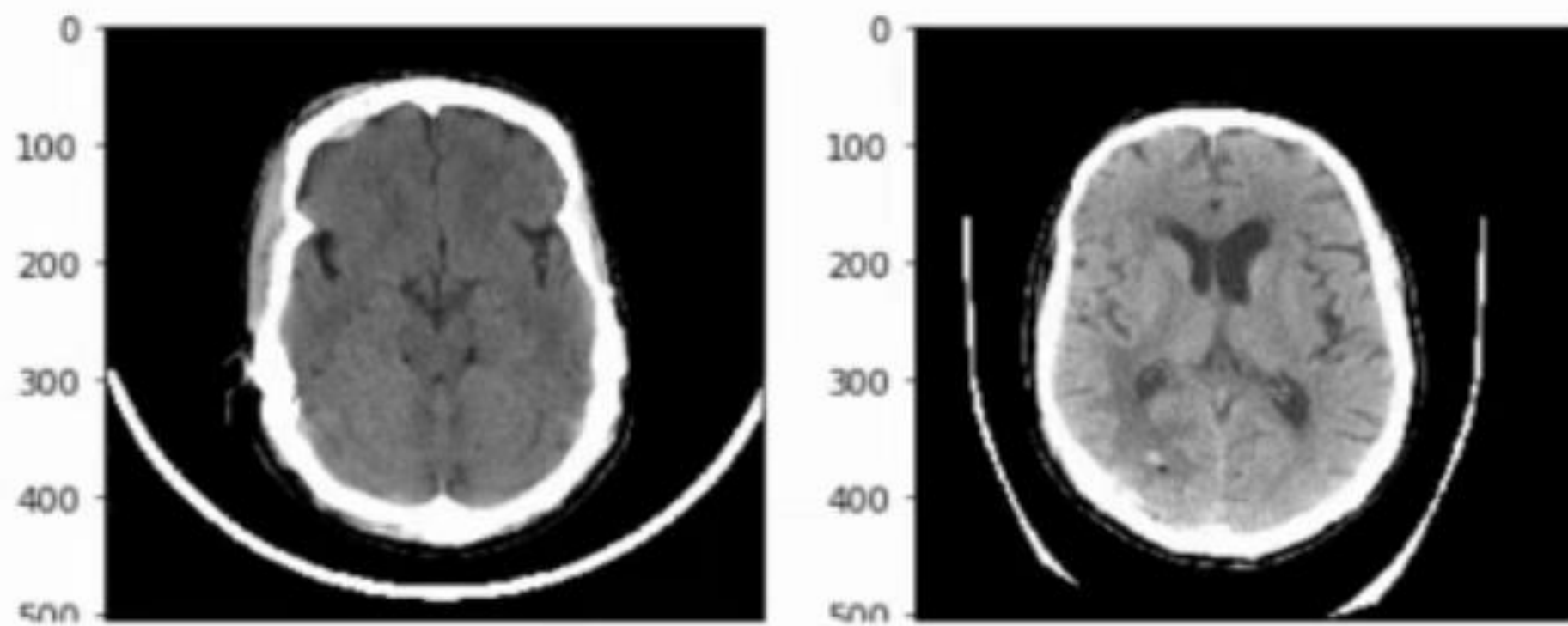
APLICAÇÕES NA MEDICINA

Benefits of AI for healthcare



The Global AI healthcare market was valued at \$7.4 billion in 2021 and is projected to grow at **49% CAGR from 2022 to 2027**, with an approximate growth to reach \$48.77 billion by 2027. By revolutionizing treatment techniques and data collection, AI in healthcare's ultimate goal is to improve patient outcomes. The data collected can help in complex disease diagnostics leading to effective treatment procedures.

2. Brain Hemorrhage: Brain CT Scans



Normal



Bacterial Pneumonia



Viral Pneumonia



HUMANOS vs INTELIGÊNCIA ARTIFICIAL



“

By providing [the pathologist or the radiologist] with decision support, we can help them become more efficient. For instance, the tools could help reduce the amount of time spent on cases with no obvious disease or obviously benign conditions and instead help them focus on the more confounding cases.

– Anant Madabhushi – the F. Alex Nason Professor II of biomedical engineering at the Case School of Engineering

So far, the tools the team have demonstrated have produced exceptionally accurate results.

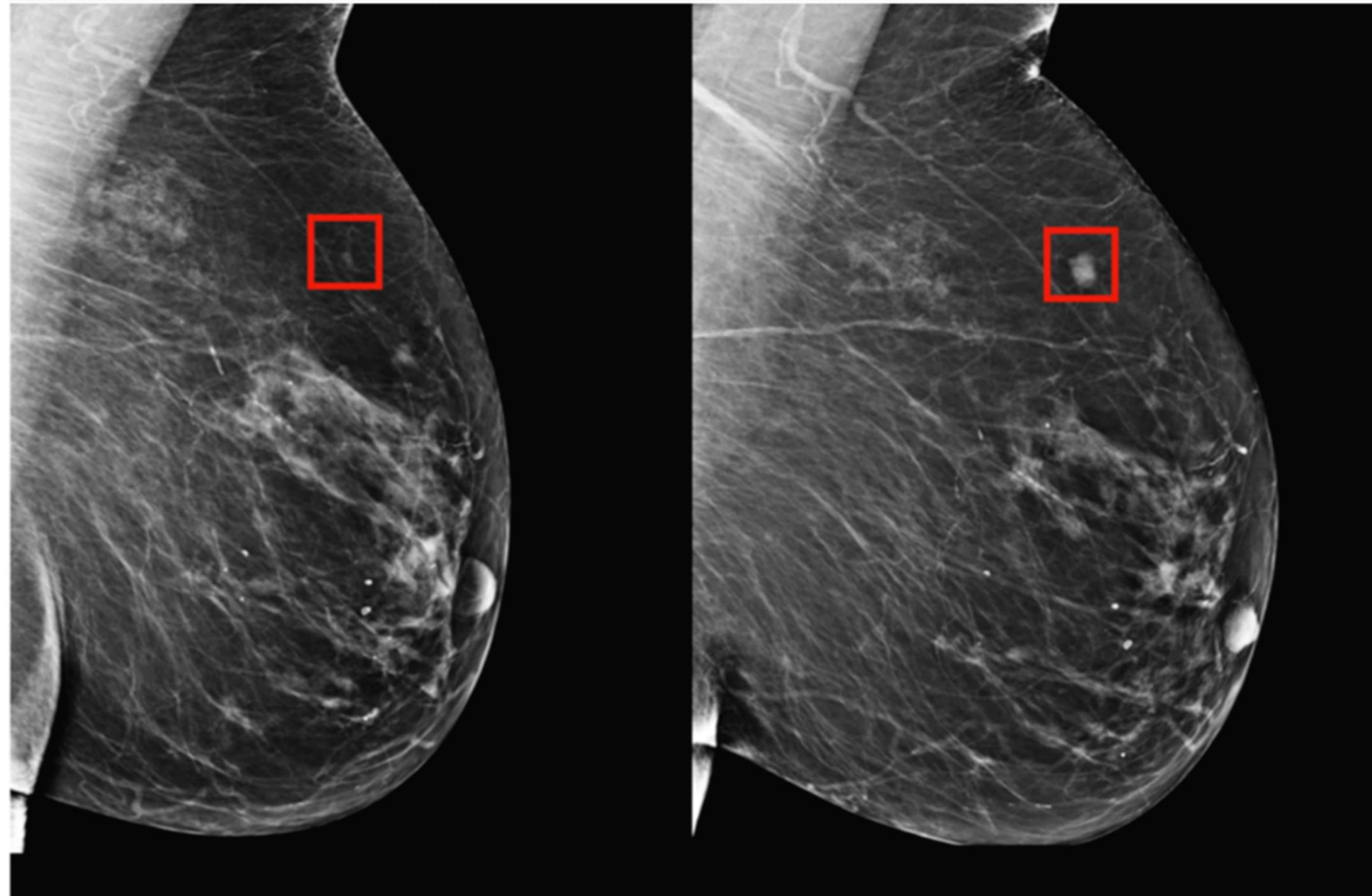
In one example, the computational-imaging system predicted with a 97% accuracy which patients were showing evidence of heart failure. While, two human doctors presented with the same information were only able to predict 74% and 73% accuracy.

Using AI to predict breast cancer and personalize care

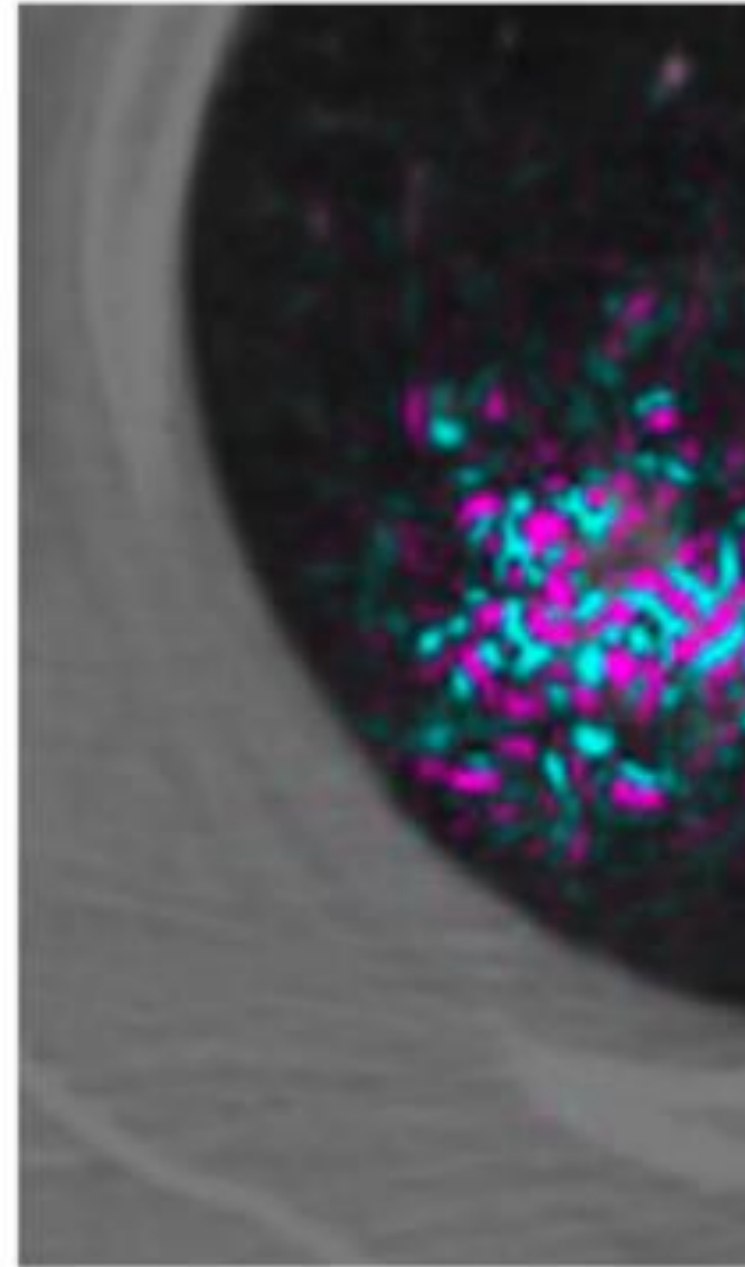
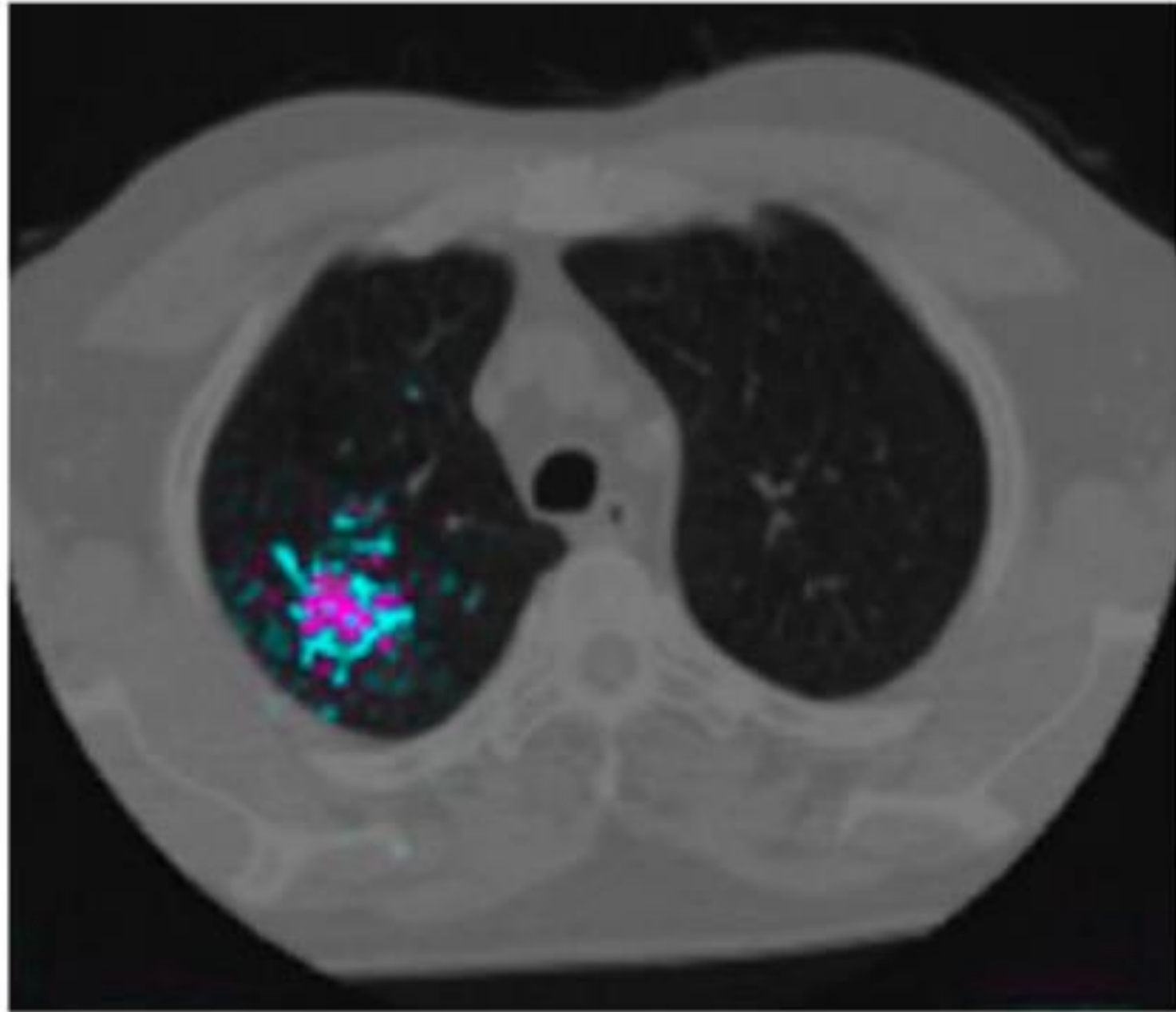
MIT/MGH's image-based deep learning model can predict breast cancer up to five years in advance.

Adam Conner-Simons and Rachel Gordon | CSAIL

May 7, 2019



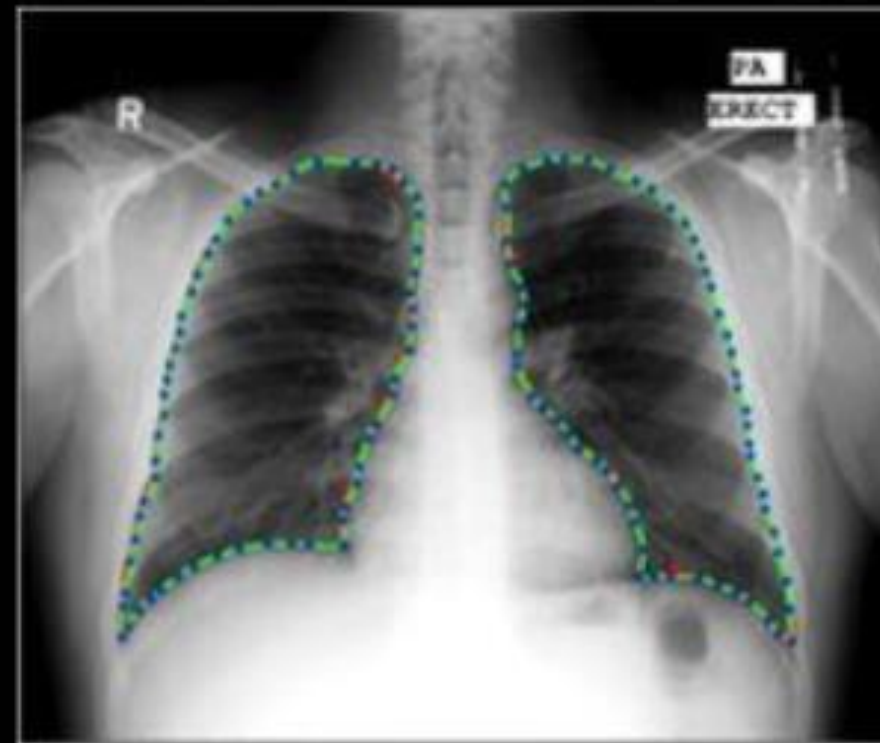
Google shows how AI might detect lung cancer faster and more reliably



Early warning: Danial Tse, a researcher at Google, developed an algorithm that beat a number of trained radiologists in testing. Tse and colleagues trained a deep-learning algorithm to detect malignant lung nodules in more than 42,000 CT scans. The resulting algorithms turned up 11% fewer false positives and 5% fewer false negatives than their human counterparts. The work is described in a paper published in the journal Nature today.

New research from Google shows how machine learning could one day be used to detect signs of lung cancer earlier than often occurs today.

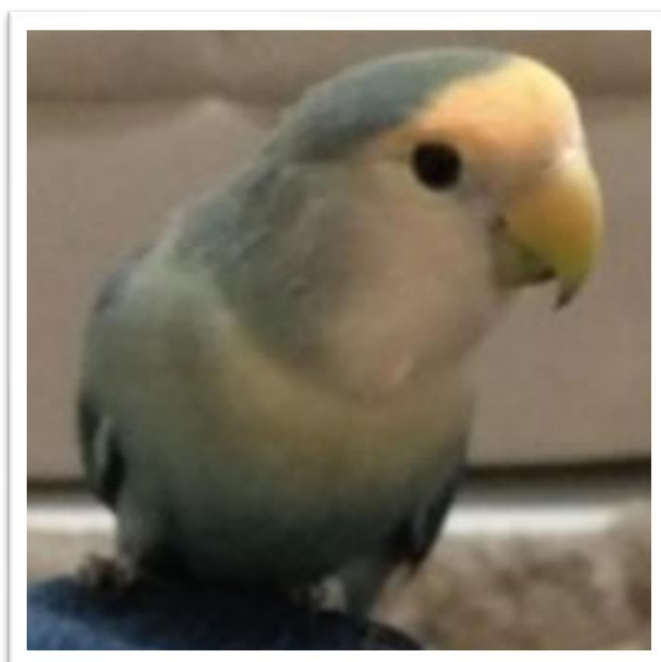
AI vs. Humans: AI Solution Beats Stanford Radiologists in Chest X-ray Diagnostics Competition



APLICACÃO: MAMOGRAFIAS

- Disponibilizada pelo A.C. Camargo Cancer Center que é um hospital oncológico especializado no diagnóstico, tratamento e pesquisa de câncer.

- 414 imagens de resolução entre 3400 a 4800 *pixels* de altura e largura.
- 91 imagens com câncer maligno e 323 benigno.



Baseado em Geometria



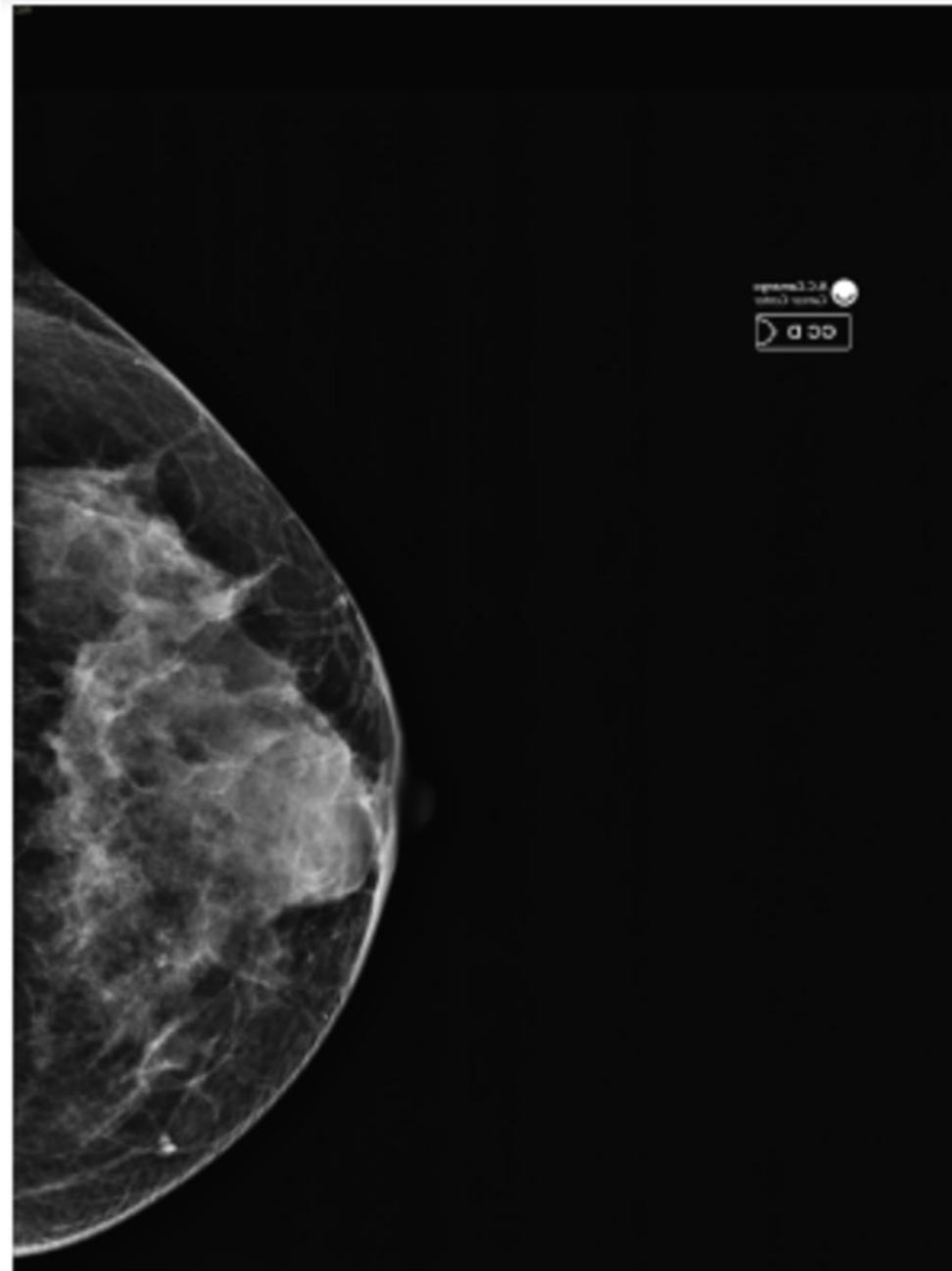
Baseado em cores



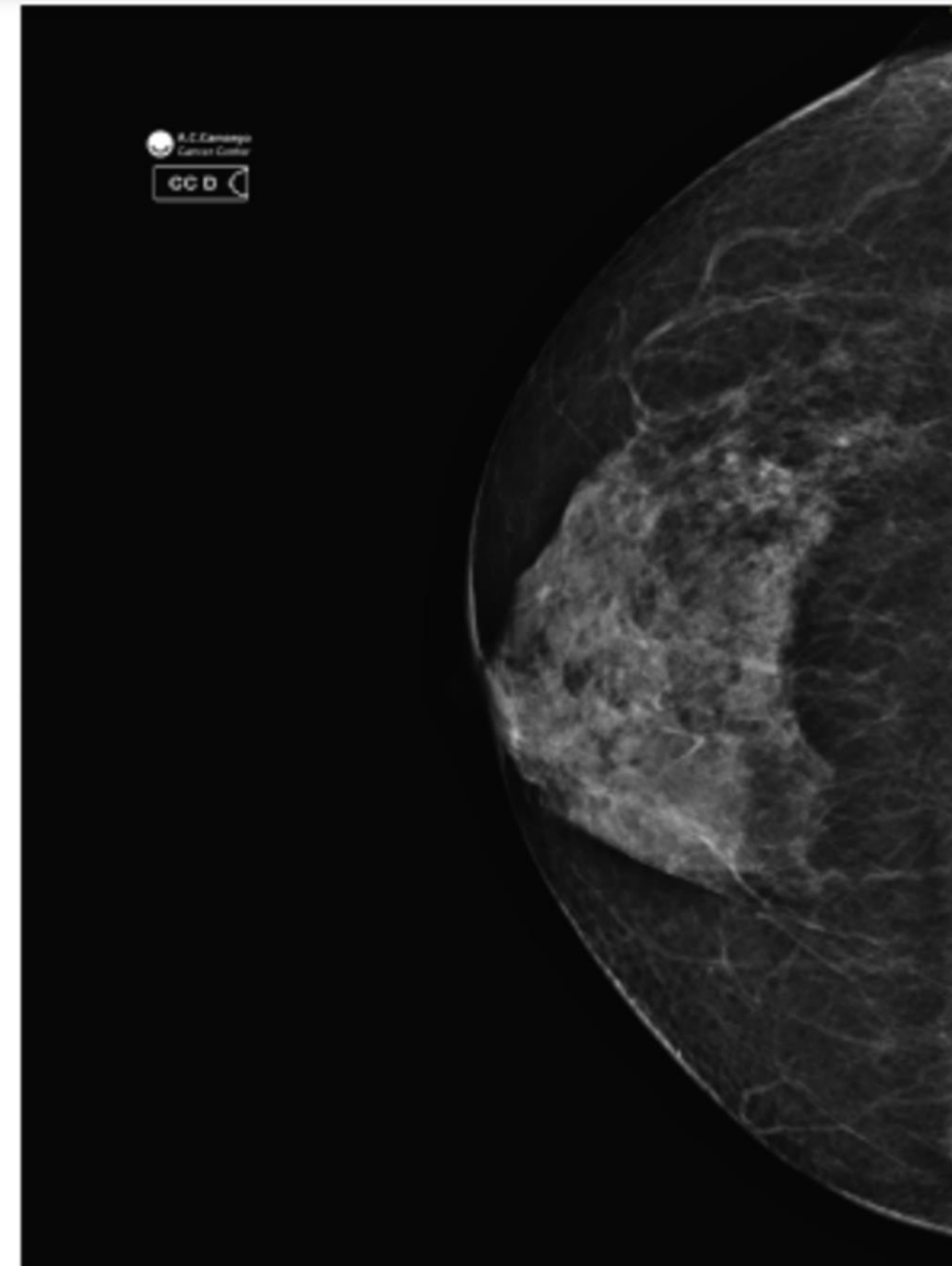
Baseado em Ruído



APLICACÃO: MAMOGRAFIAS

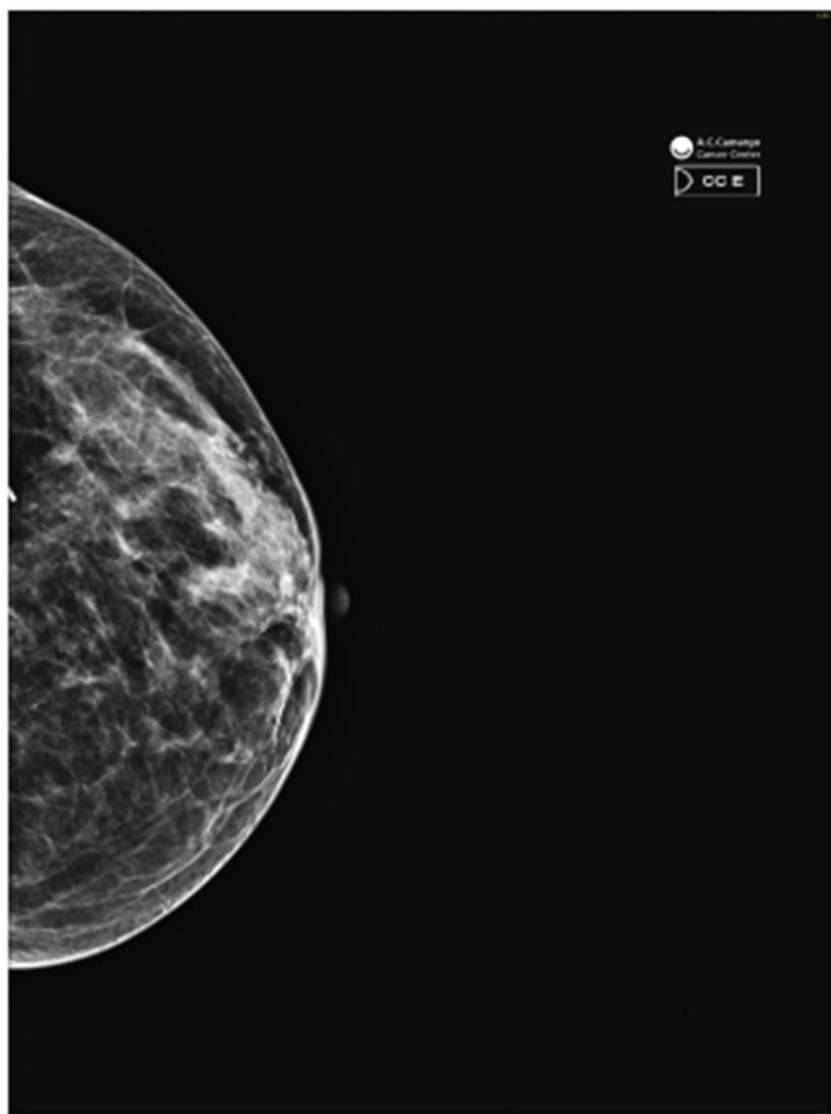


(a) Benigno

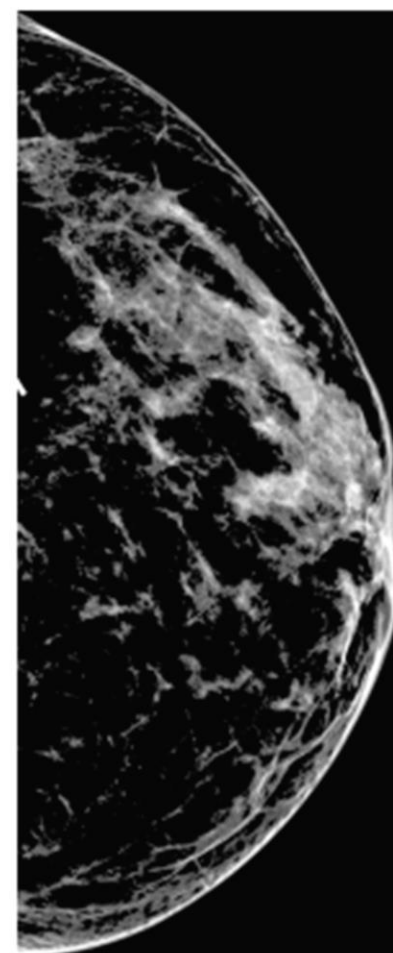


(b) Maligno

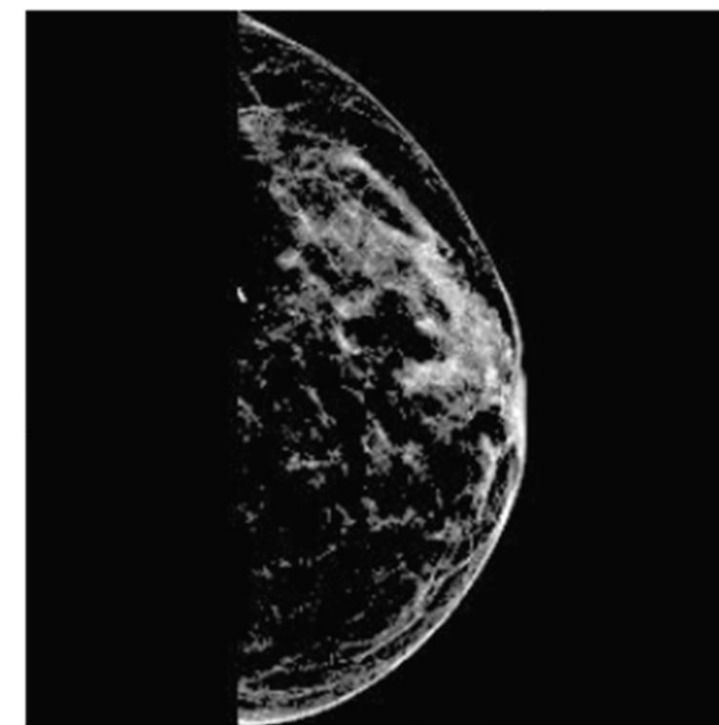
APLICACÃO: MAMOGRAFIAS



a) Imagem original



b) Corte e Filtro



c) Imagem final

FUTURO: HOSPITAIS INTELIGENTES



Oct 19, 2022

What will tomorrow's smart hospital look like?



Operational efficiency

Optimizing workflows and resource utilization to free up focus for patient care



Clinical excellence

Using data-driven insights for enhanced clinical quality and efficiency



Experience-centricity

Creating frictionless experiences for patients within and beyond hospital walls



Innovation capability

Creating a culture of continuous innovation and improvement



EM RESUMO

- 1. AUXILIA OS MÉDICOS NA TOMADA DE DECISÃO**
- 2. CRIA AGILIDADE NOS DIAGNÓSTICOS**
- 3. DIMINUI A NECESSIDADE DE EXAMES**

A glowing lightbulb is centered in the background, emitting a bright blue light that fades into the surrounding blue gradient. The lightbulb is slightly out of focus, creating a soft, ethereal glow.

DÚVIDAS?!