UNIVERSIDAD
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Aprendizaje Automático 1

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Objetivos

- El alumno tendrá una introducción a técnicas clásicas de Machine Learning clásicas. Aprenderá los modelos tradicionales, desde su concepción teórica hasta su implementación en lenguajes de cómputo.

- Se verán técnicas como regresión lineal, logística, Máquinas de soporte vectorial, métodos de agrupamiento y otras técnicas de aprendizaje no supervisado.

Temario Aprendizaje Máquina 1

Introducción

- Historia del Aprendizaje Máquina
- Aplicaciones en la Industria
  - Marketing
  - Servicios
  - Maquinaria
- **Aprendizaje Supervisado**
  - Regresión Lineal
    - Gradiente Descendente
    - Regularización
  - Regresión Logística
  - Máquinas de Soporte Vectorial
    - Truco del Kernel
- **Aprendizaje No Supervisado**
  - Técnicas de Agrupamiento
    - K-Means
    - Modelos Gaussianos
  - Técnicas de Reducción de Variables
    - Análisis de Componentes Principales

Aprendizaje Máquina 2

- Aprendizaje Reforzado
  - Políticas
  - Funciones de recompensa
  - Aprendizaje Q
- Aprendizaje Supervisado
  - Redes Neuronales
    - Aprendizaje Profundo
    - Optimización
    - Redes Neuronales Convolutivas
    - Redes Neuronales Recurrentes
- Estadística Bayesiana
  - Probabilidad
  - Funciones de similitud
  - Muestreadores de Cadenas de Markov
    - Muestreo de Gibbs
  - Modelos Bayesianos Jerárquicos
  - Modelos Bayesianos No Paramétricos

Evaluación

- Proyecto Final es el 60% de la evaluación final
  - El proyecto final consiste en el uso y validación de una(s) técnica(s) de aprendizaje máquina en una aplicación práctica.
  - Se pueden formar grupos hasta de 3 personas.
  - Es necesario entregar un reporte tipo artículo de los datos, metodología y conclusiones además de una presentación de 10 minutos del trabajo.
- Actividades varias contarán como 40% de la evaluación final
  - Tareas
  - Reportes de lecturas
  - Prácticas

Políticas

- La asistencia del 80% es obligatoria.
- La calificación aprobatoria es 8.0.
- Política de integridad académica- copia será sancionada

Módulo I.

¿Qué es Aprendizaje Automático?

- Es el estudio de algoritmos que :
  - Mejoran el desempeño P
  - De alguna tarea T
  - Con experiencia E

Una tarea de aprendizaje bien definida : <P,T,E>

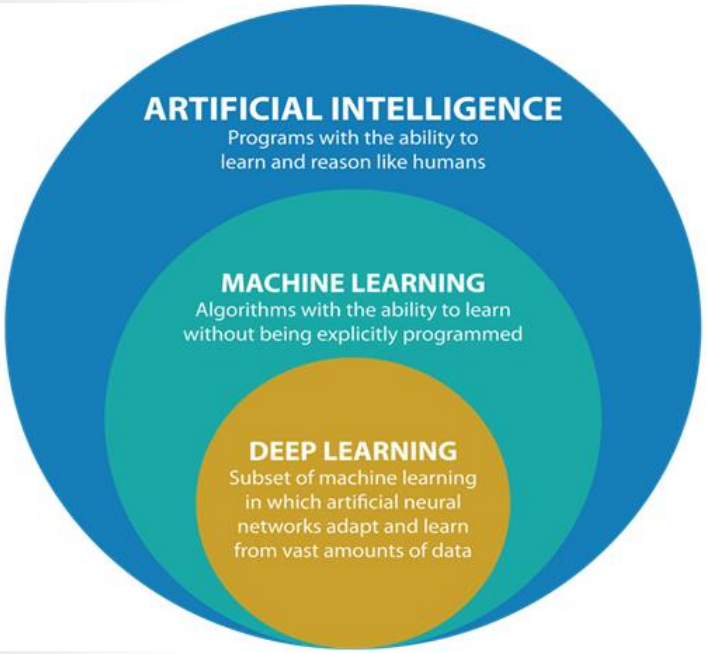
¿Qué es Aprendizaje Automático?

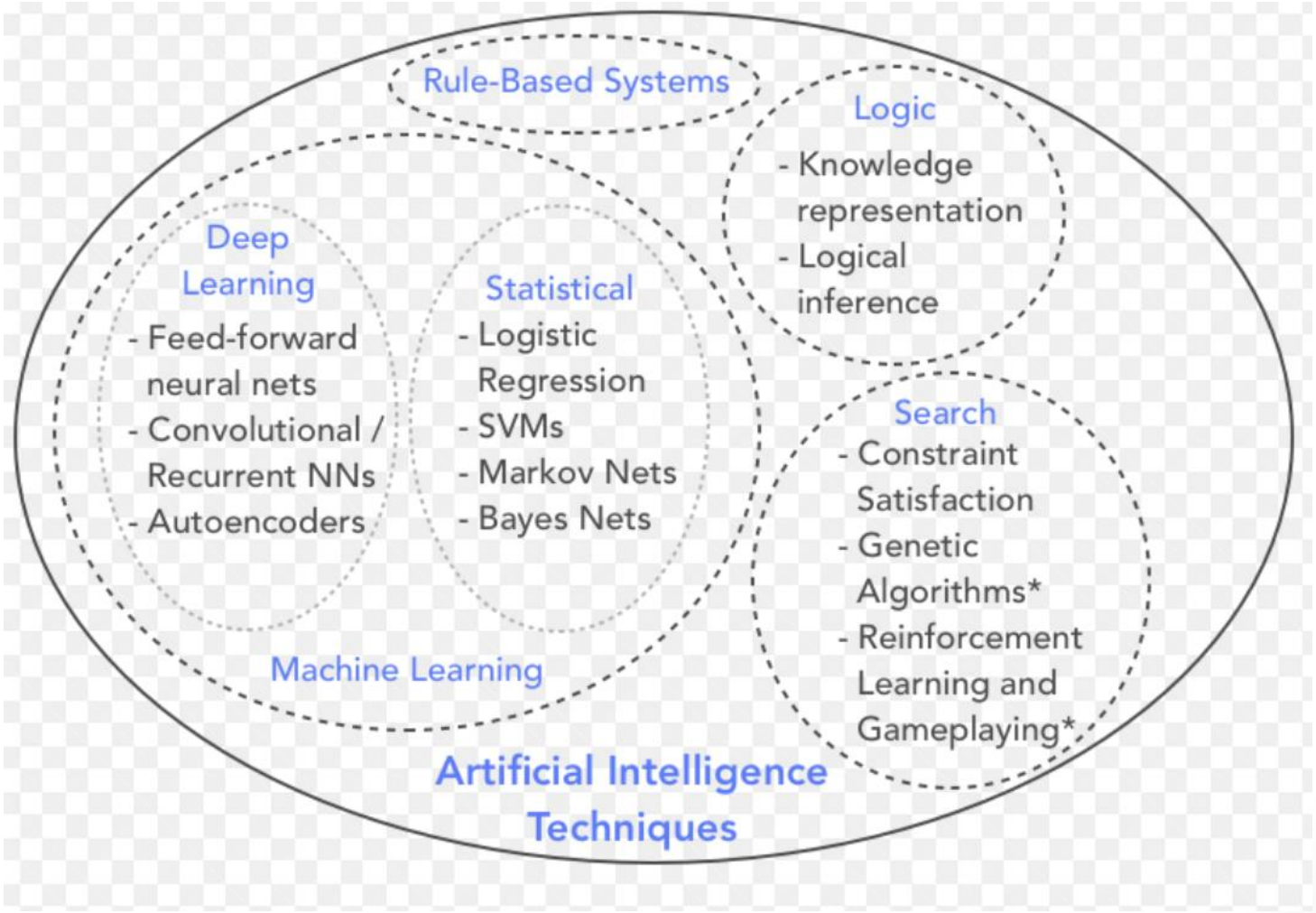
- “Machine learning is the study of computer algorithms that improve automatically through experience”

- “A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E.”

Tom Mitchell

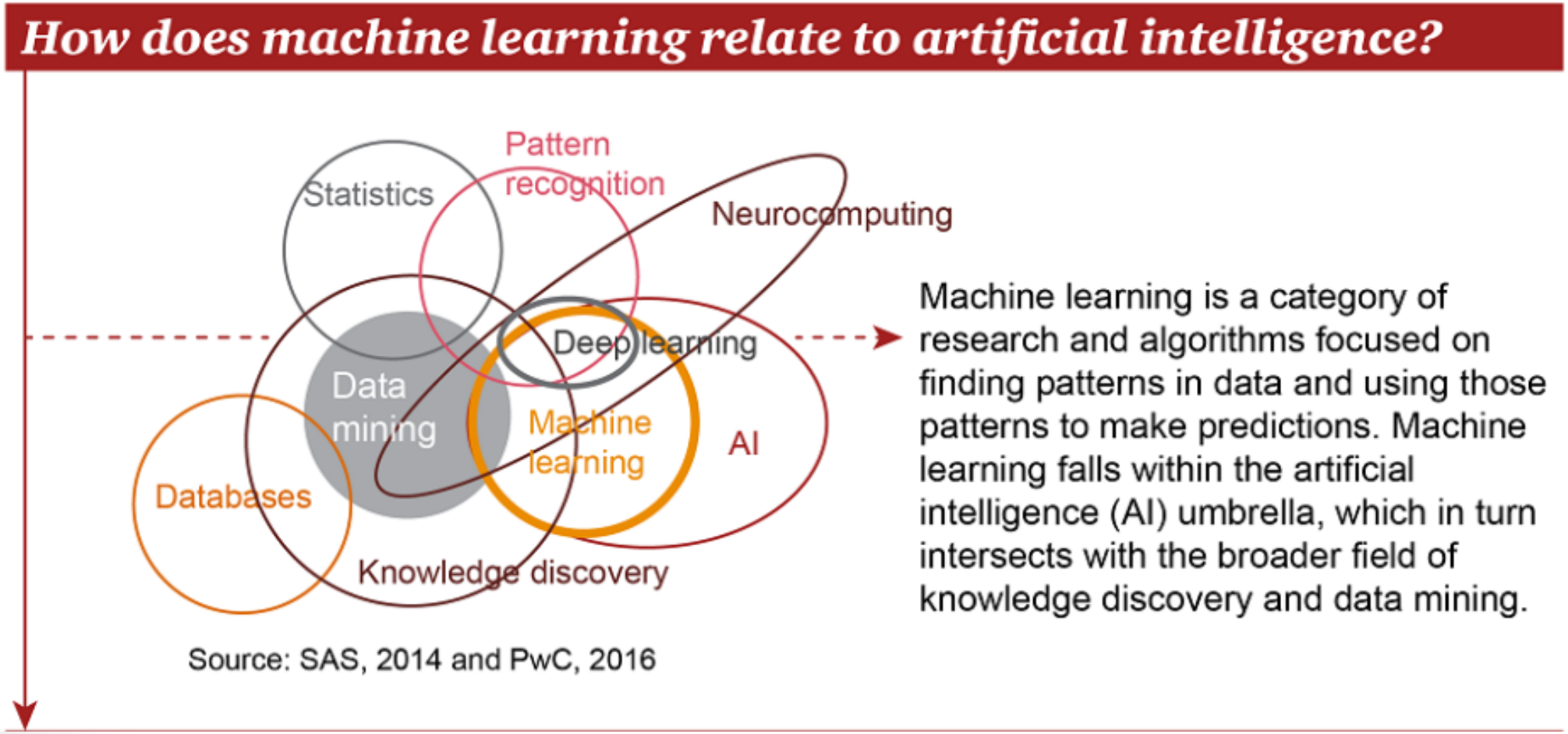
Diferencia de IA con Aprendizaje Máquina





https://medium.com/@jorgesleonel/artificial-intelligence-78937d8b46d4

Diferencia de IA con Aprendizaje Máquina



Historia del Aprendizaje Automático

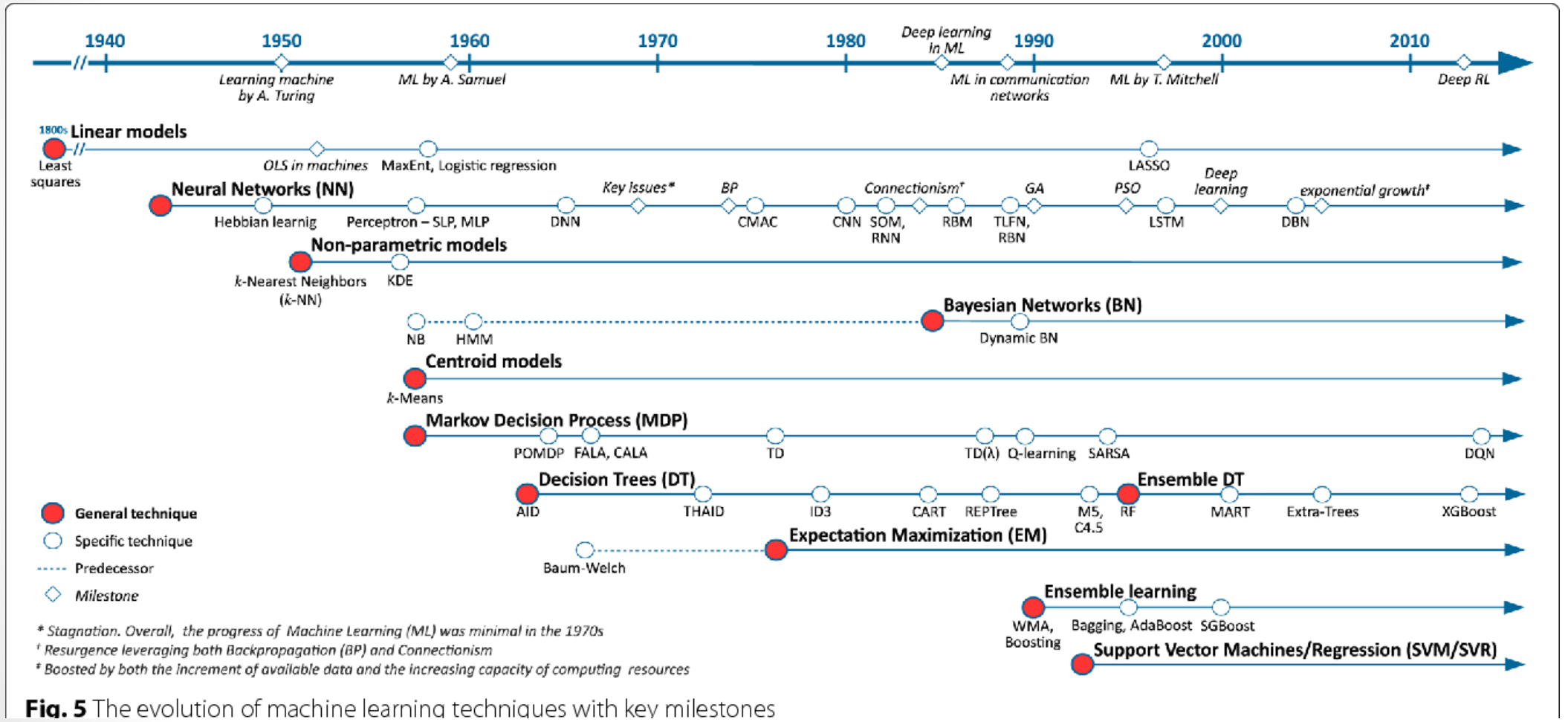


Fig. 5 The evolution of machine learning techniques with key milestones

What are the five tribes?

Symbolists	Bayesians	Connectionists	Evolutionaries	Analogizers
Animals; Mammals Birds	Likelihood | Prior; Posterior | Margin	Cell body; Synapse		
Use symbols, rules, and logic to represent knowledge and draw logical inference	Assess the likelihood of occurrence for probabilistic inference	Recognize and generalize patterns dynamically with matrices of probabilistic, weighted neurons	Generate variations and then assess the fitness of each for a given purpose	Optimize a function in light of constraints ("going as high as you can while staying on the road")
Favored algorithm Rules and decision trees	**Favored algorithm** Naive Bayes or Markov	**Favored algorithm** Neural networks	**Favored algorithm** Genetic programs	**Favored algorithm** Support vectors

Source: Pedro Domingos, *The Master Algorithm*, 2015

Phases of evolution

1980s	1990s to 2000	Early to mid-2010s
Predominant tribe Symbolists	**Predominant tribe** Bayesians	**Predominant tribe** Connectionists
Architecture Server or mainframe	**Architecture** Small server clusters	**Architecture** Large server farms (the cloud)
Predominant theory Knowledge engineering	**Predominant theory** Probability theory	**Predominant theory** Neuroscience and probability
Domain experts; Knowledge engineer; Knowledge base/ Inference engine	Spam classifier; Non-spam classifier	Pixels; Edges; Object parts; Objects
Basic decision logic: Decision support systems with limited utility	**Classification:** Scalable comparison and contrast that's good enough for many purposes	**Recognition:** More precise image and voice recognition, translation, sentiment analysis, etc.

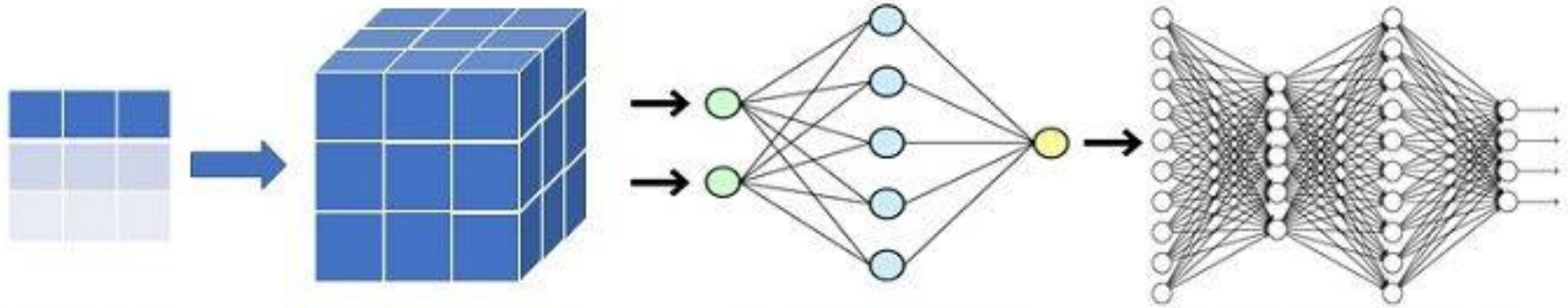
The tribes see fit to collaborate and blend their methods

Late 2010s	2020s+	2040s+
Predominant tribe Connectionists + Symbolists	**Predominant tribe** Connectionists + Symbolists + Bayesians + ...	**Predominant tribe** Algorithmic convergence
Architecture Multiple clouds	**Architecture** Clouds and fog	**Architecture** Server ubiquity
Predominant theory Memory neural networks, large-scale integration, and reasoning over knowledge	**Predominant theory** Networks when sensing, but rules when reasoning and acting	**Predominant theory** Best-of-breed meta-learning
Human; use; Machine; Wikipedia; Wikidata; DBpedia; KBpedia; define; Platform; Neural net; generate; learn; Domain-specific training corpus	Domain experts; Knowledge engineer; Knowledge graph/ Inference engine; Spam classifier; Non-spam classifier; Pixels; Edges; Object parts; Objects	
Source: Cognonto, 2016		
Simple question answering: Narrow, domain-specific knowledge sharing	**Simple sensing, reasoning, and actions:** Bounded autonomy or human-machine interaction	**Sensing and responding:** Act or answer based on knowledge or experience gained through various kinds of learning

Source: PwC, 2016

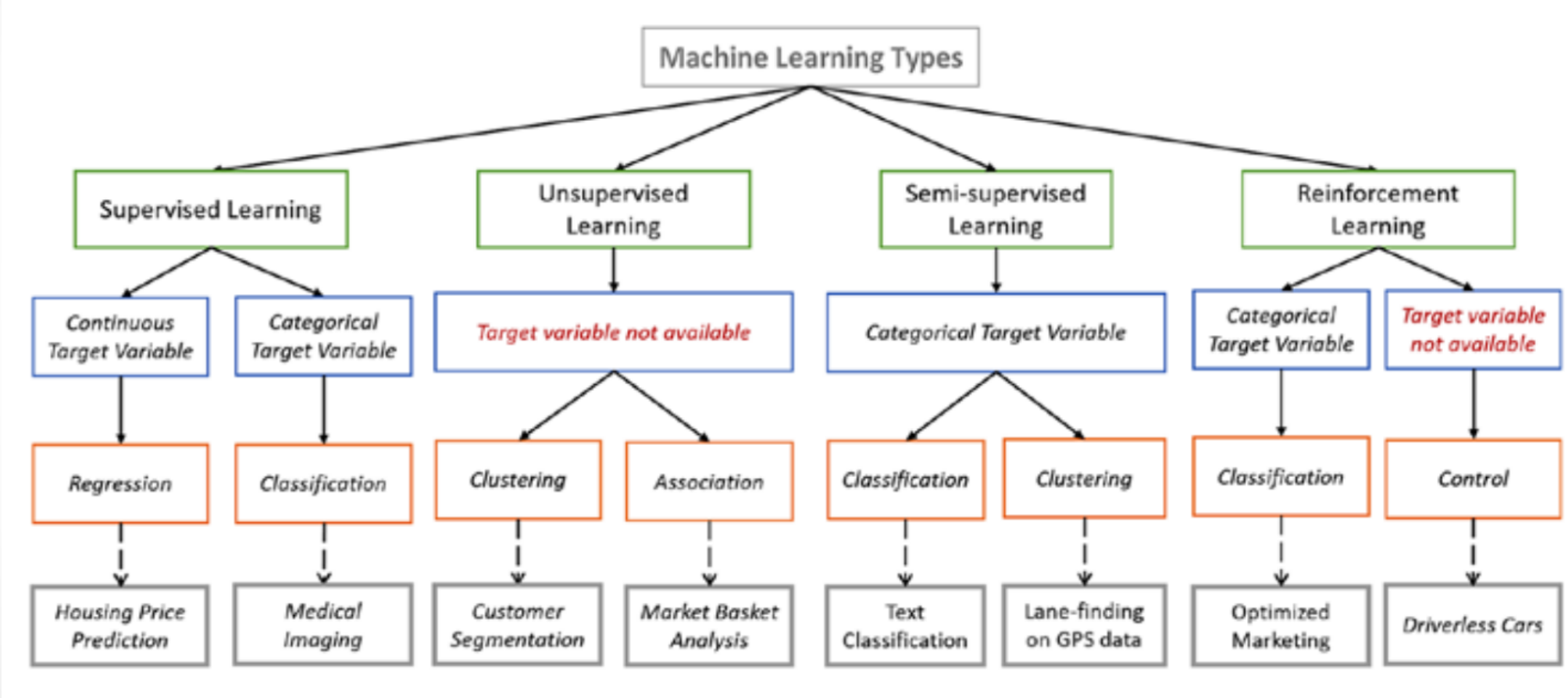
pwc.com/NextinTech

Evolution of Machine Learning



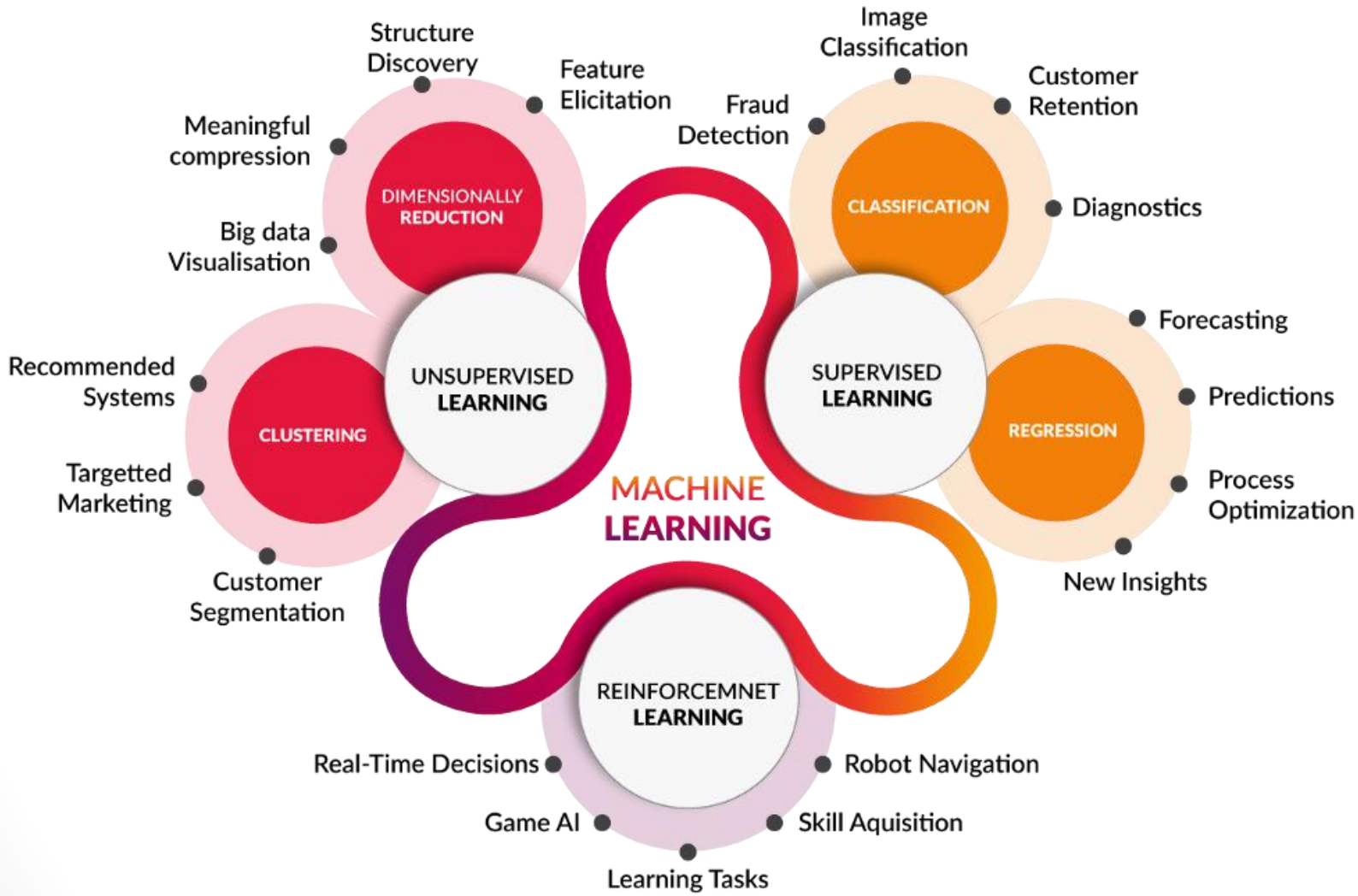
#TechBytes by Vishal Singhal

Tipos de aprendizaje máquina



https://towardsdatascience.com/types-of-machine-learning-algorithms-you-should-know-953a08248861

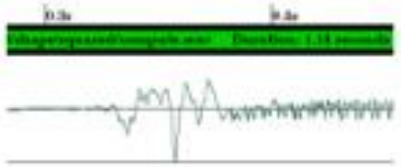
Tipos de aprendizaje máquina



https://www.experfy.com/blog/coding-deep-learning-for-beginners-types-of-machine-learning

En la práctica….

Mining Databases



Speech Recognition

Control learning

Object recognition

Text analysis

- Support Vector Machines
- Bayesian networks
- Hidden Markov models
- Deep neural networks
- Reinforcement learning
- ….

THIS STORY IS FROM FEBRUARY 07, 2019

Google using machine learning to filter spam on Gmail

TIMESOFINDIA.COM | Feb 7, 2019, 12:43 IST

NEW DELHI: Tech giant Google is doing everything possible to get rid of spam mails. The company has now taken help of in-house machine learning system. Called TensorFlow, the tool will help filter additional spam for Gmail users. The company started using the new filters last month and claims that it has managed to block extra 100 million spam messages every day with its help.

TensorFlow was initially developed for Google's internal use. The company released the machine learning framework under the Apache 2.0 license three years ago. The company claims since then the developers from all around the globe has produced 71,000 forks of public code and other open source contributions.

As reported by The Verge, the company says incorporating TensorFlow into Gmail will enable it to personalise spam filters in a better manner. This complete process has been taking place for years where Gmail looks for some particular signals from users on the basis of which it judges the spam. However, with TensorFlow the company is now able to turn these signals into better results.

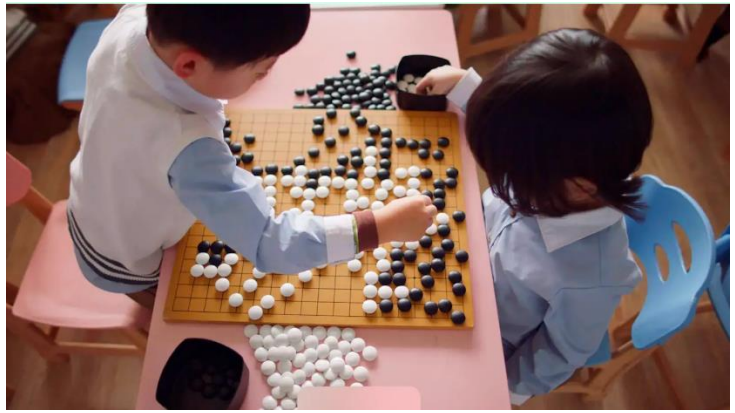
Machine learning has been through several transition periods starting in the mid 90's. From 1995 – 2005, there was a lot of focus on natural language, search, and information retrieval. The machine learning tools were simpler than what we're using today; they include things like logistic regression, SVMs (support vector machines), kernels with SVMs, and PageRank. Google became immensely successful using these technologies, building major success stories like Google News and the Gmail spam classifier using easy-to-distribute algorithms for ranking and text classification – using technologies that were already mature by the mid 90's.

Reza Zadeh, Stanford University

"TensorFlow makes managing this data at scale easier, while the open-source nature of framework means new research from the community can be quickly integrated"

MAKING HISTORY

AlphaGo is the first computer program to defeat a professional human Go player, the first to defeat a Go world champion, and is arguably the strongest Go player in history.



https://deepmind.com/research/case-studies/alphago-the-story-so-far

> **I thought AlphaGo was based on probability calculation and that it was merely a machine. But when I saw this move, I changed my mind. Surely, AlphaGo is creative.**

LEE SEDOL
WINNER OF 18 WORLD GO TITLES

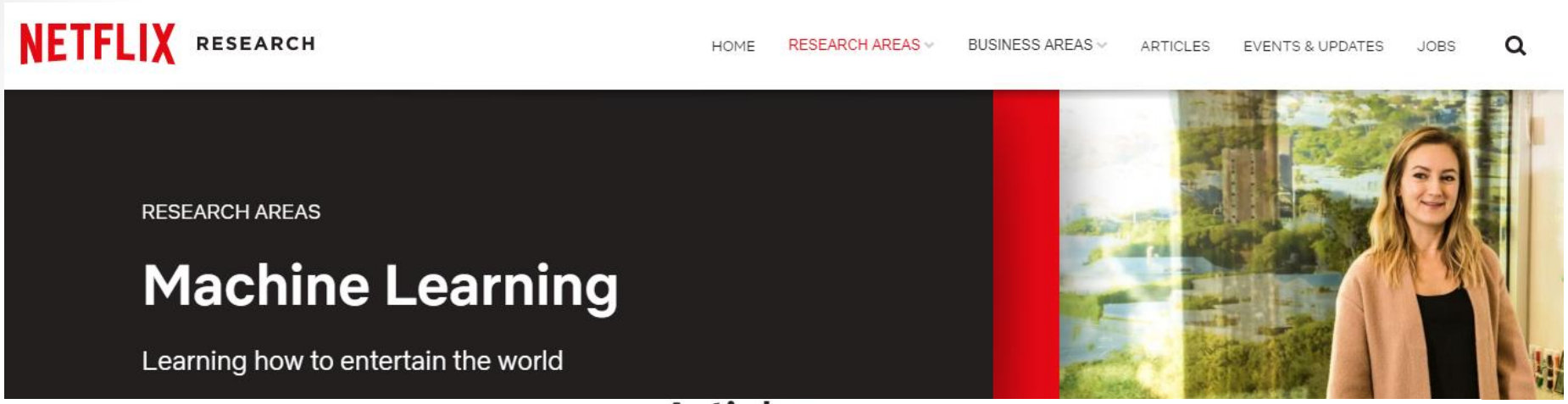
about amazon

Innovation

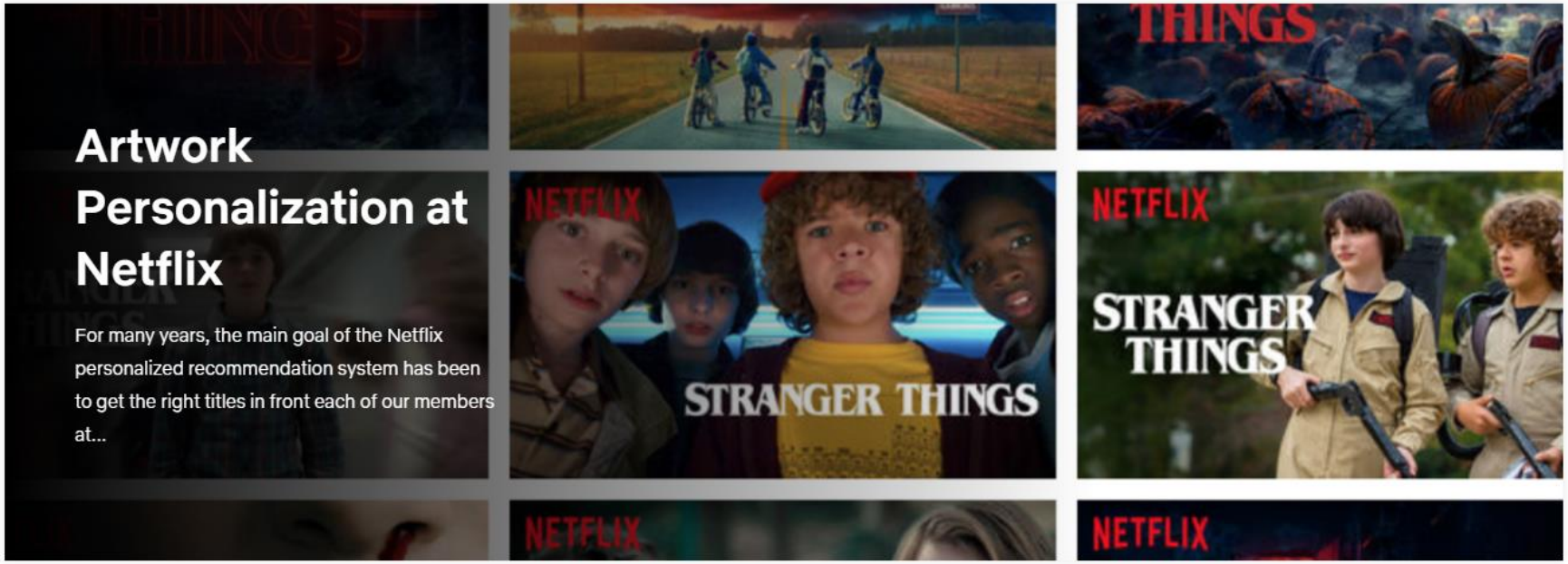
How artificial intelligence helps Amazon deliver

An Amazon chief scientist explains how machine learning keeps Amazon warehouses humming.

https://blog.aboutamazon.com/innovation/how-artificial-intelligence-helps-amazon-deliver



Articles

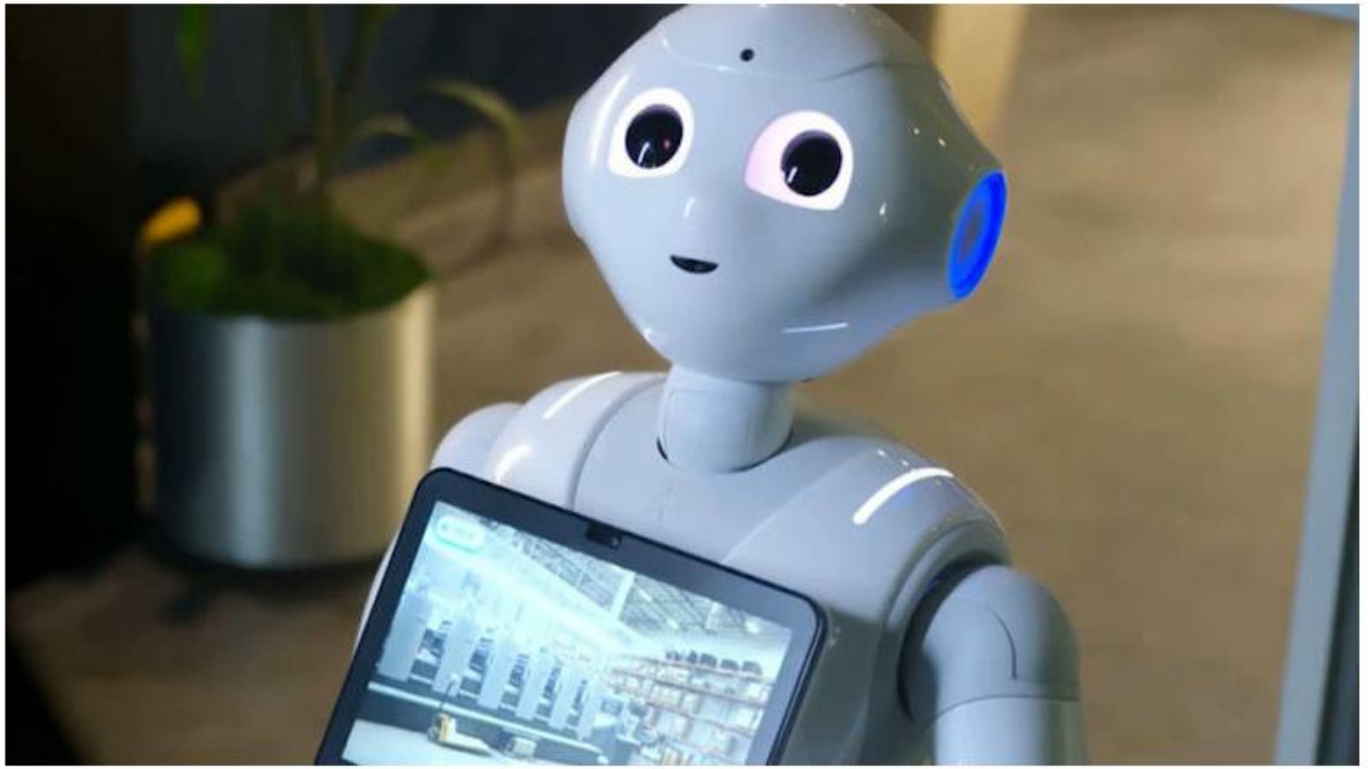


https://research.netflix.com/research-area/machine-learning

https://becominghuman.ai/how-netflix-uses-ai-and-machine-learning-a087614630fe

Assistive robots in the spotlight of TechCrunch robotics event

Mark Niu @MarkNiuWrite



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https://www.youtube.com/watch?v=B8R148hFxPw

https://www.youtube.com/watch?v=DjAJnQoNdMA

https://iiot-world.com/machine-learning/machine-learning-algorithms-in-autonomous-driving/