



Birla Institute of Technology and Science Pilani, Hyderabad Campus  
2<sup>nd</sup> Semester 2023-24

11.01.2024

# **BITS F464: Machine Learning**

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## **COURSE ADMINISTRATION & MOTIVATION**

Chittaranjan Hota, Sr. Professor  
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Acknowledgements: Christopher Bishop, Tom Mitchell, Kevin Murphy, Jeremy Watt

# Course Information

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## Course Page:

<https://www.bits-pilani.ac.in/hyderabad/teaching/?faculty=chittaranjanhota>

<https://classroom.google.com/> (for Notices and Evaluations)

## Team:

Instructor In-Charge:

Chittaranjan Hota, [hota@hyderabad.bits-pilani.ac.in](mailto:hota@hyderabad.bits-pilani.ac.in), LTC: F-106

TAs:

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Harsha Varun Marisetty, [p20200437@hyderabad.bits-pilani.ac.in](mailto:p20200437@hyderabad.bits-pilani.ac.in)

S. Shashank, [p20210412@hyderabad.bits-pilani.ac.in](mailto:p20210412@hyderabad.bits-pilani.ac.in)

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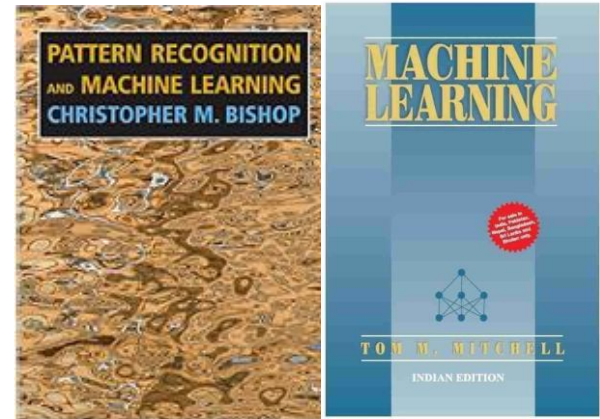
# Text and Reference Books

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## Text Books:

T1: Christopher Bishop: Pattern Recognition  
Springer-Verlag New York Inc., 2006.

T2: Tom M. Mitchell: Machine Learning, MGH  
Edition, 2017.



## Reference Books:

R1: Kevin Murphy: Machine Learning: A Probabilistic Perspective, MIT  
Press, 2012.

R2: Shai Shalev-Shwartz and Shai Ben-David: Understanding Machine  
Learning: From Theory to Algorithms, Cambridge University Press,  
2014.

R3: Ethem Alpaydin: Introduction to Machine Learning, 3<sup>rd</sup> Edition, MIT  
Press, 2014.

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# Evaluation Scheme

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Component	Duration	Date & Time	Weightage	Nature of Component
Mid-Semester Exam	90 mins	14/03/2024 (2:00 to 3:30pm)	30%	Closed Book
Home Assignments/ Projects (coding)	-	To be announced	20%	Open Book
Two announced quizzes	30 mins each	Second week of Feb, and First week of April 2024.	10%	Open Book
Comprehensive Exam	3 Hrs	15/05/2024 (FN)	40%	Closed Book

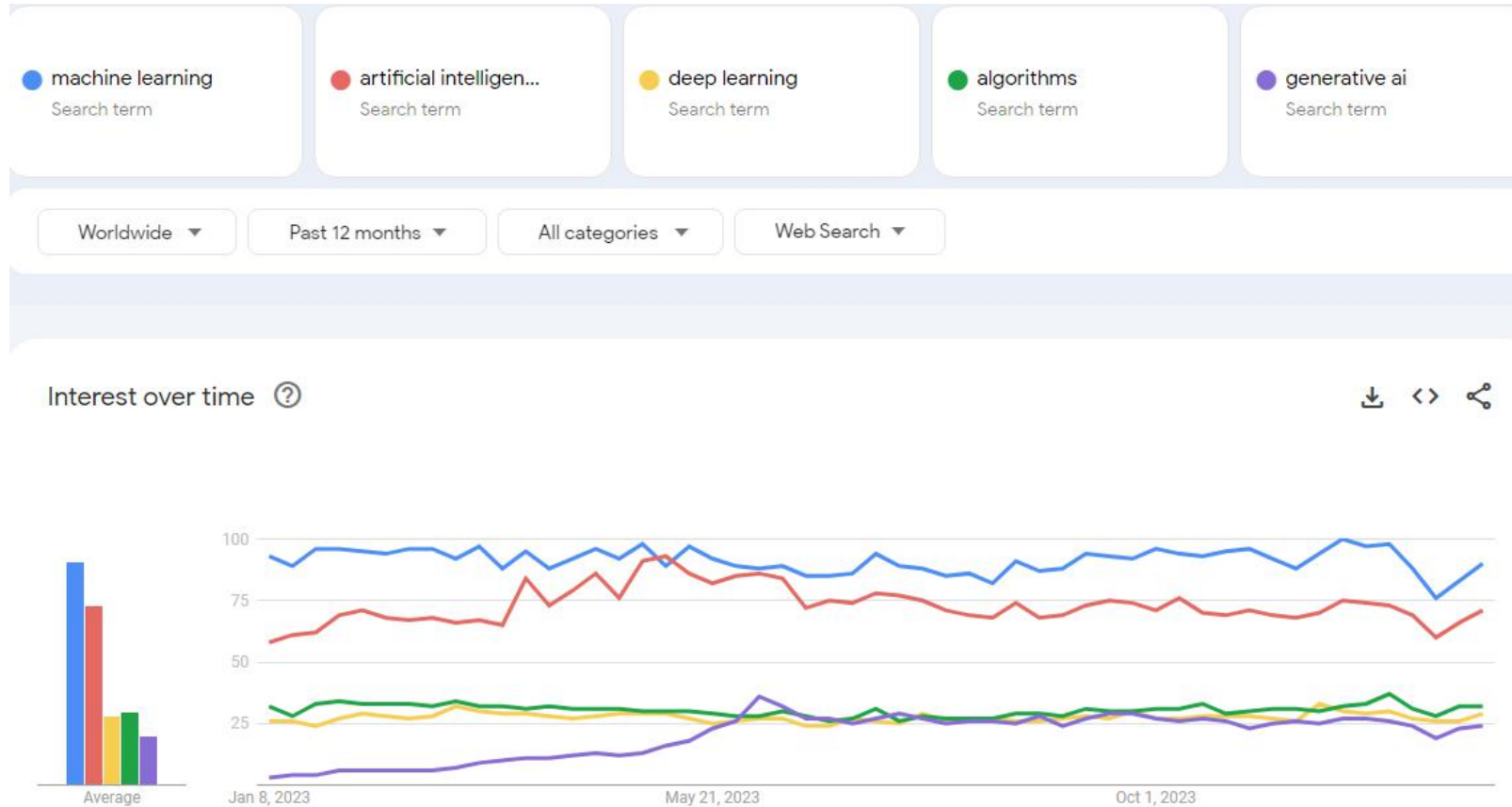
(Note: Minimum 40% of the evaluation component will be conducted before the mid semester grading, 10 to 12 Coding Assignments)

Chamber consultation hour: Monday 5:00 pm to 6:00 pm (H-137)

Notices: All notices about the course will be put on the google class.

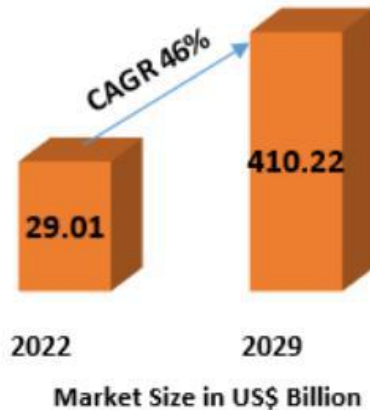
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# Machine Learning Trend



On 9<sup>th</sup> Jan 2024: Source: <https://trends.google.com/trends>

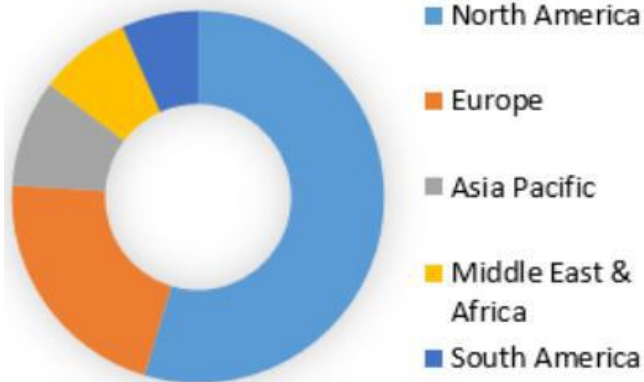
# Machine Learning Growth Rate



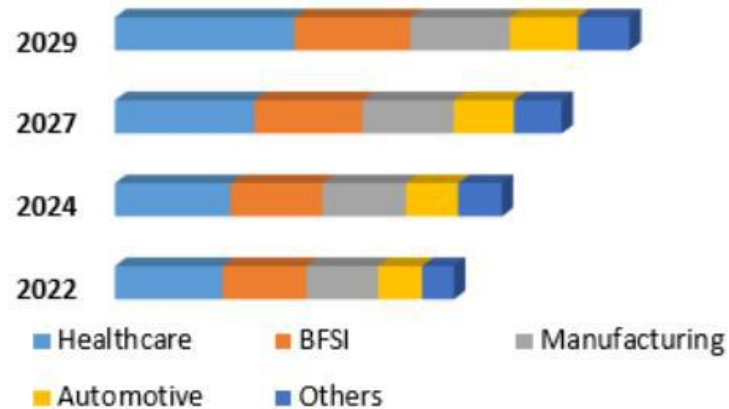
## Key Players

Amazon Web Services, Inc.	Hewlett Packard Enterprise Development LP
Baidu, Inc.	Intel Corporation
Domino Data Lab, Inc.	IBM Corporation
Microsoft Corporation	KNIME.com AG
Dataiku	RapidMiner, Inc.
Luminoso Technologies, Inc.	Angoss Software Corporation
TrademarkVision	H2O.ai
SAP SE	

## Regional Analysis in 2022 (%)



## Industry Segment Overview



# Machine Learning: Motivation

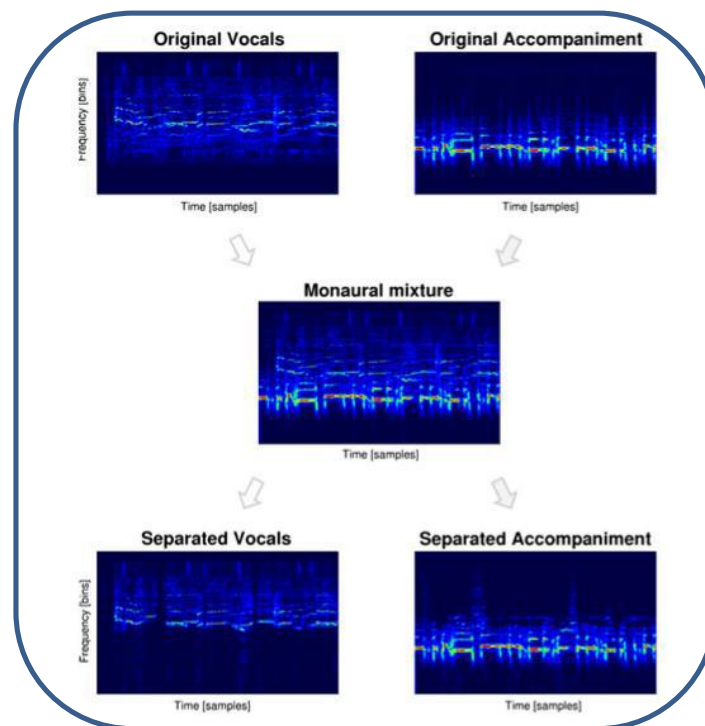
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- How can we solve a specific problem?
  - Let us say, how did you register into this course two days back?



Img. Source: Josh H. McDermott

How to solve the cocktail party problem?



(Img. source: Deep Karaoke: Extracting Vocals from Musical Mixtures Using a Convolutional DNN, Andrew Simpson ...)

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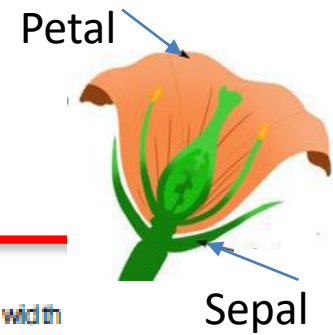
How can a Robot cook?

Is it a dog or a fox in the image?

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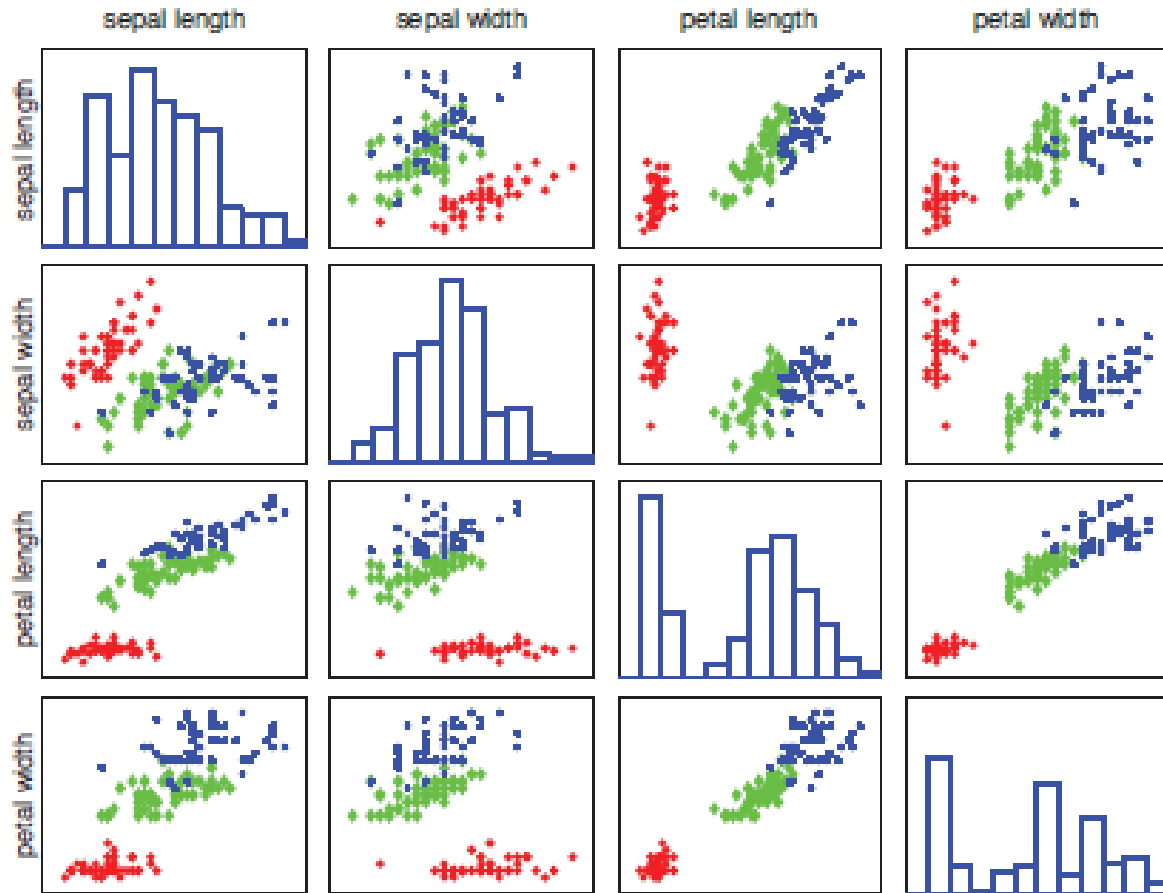
Setosa



Versicolor



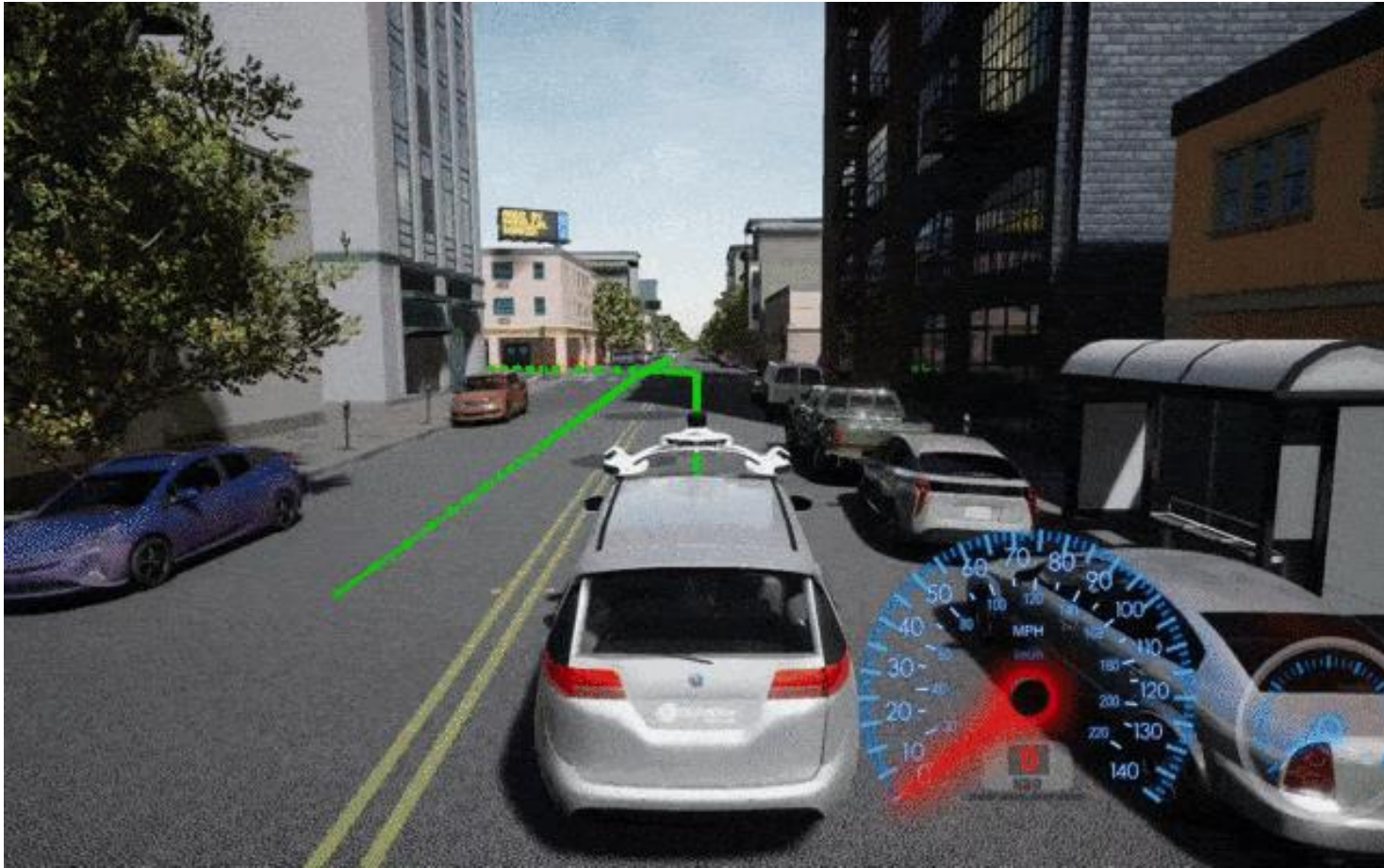
Virginica



(Scatter plot with 4 features)

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Self-driving Cars, Source: <https://neptune.ai/>

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# Continued...


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**NETFLIX** UNLIMITED

## Movies


Movies move us like nothing else can, whether they're scary, funny, dramatic, romantic or anywhere in-between. So many titles, so much to experience.

Popular on Netflix




Recently added

Hi Nanna



Recently added

Annapoorani



JAWAN  
EXTENDED CUT

Jawan: Extended Cut

Recommender System

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# Continued...

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mahatma gandhi


All Images Videos News Maps More Tools

About 10,00,00,000 results (0.52 seconds)

## Mahatma Gandhi

Indian lawyer

Overview History Books Education Movies Products



ullstein bild Dtl./ullstein bild via Getty Images

MKGandhi.org  
MAHATMA GANDHI ONE SPOT COMPLETE INFORMATION ...  
World's most visited, popular and comprehensive Mahatma Gandhi information website, well-worth...

Born  
2 October 1869  
Porbandar

Assassinated  
30 January 1948, Birla House, New...

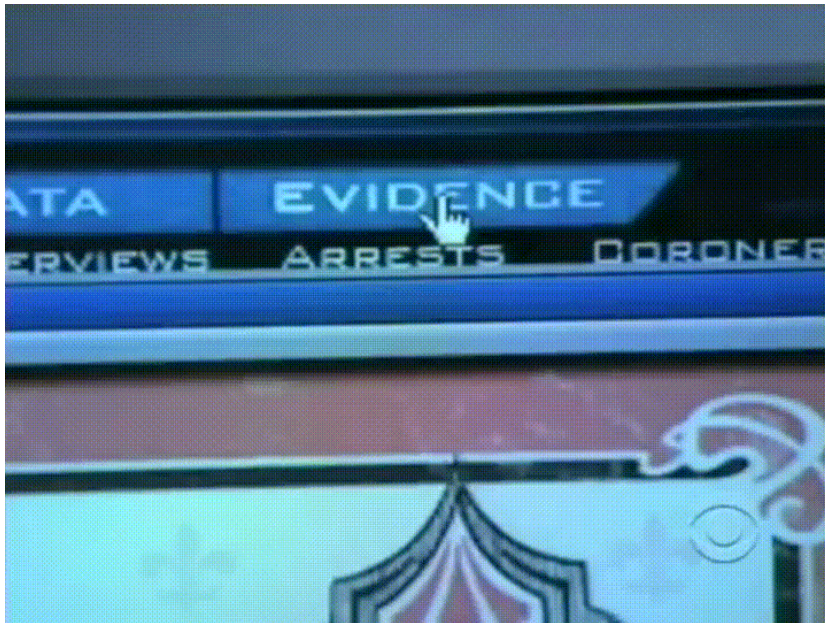
The Indian Express  
Mahatma Gandhi: Get Latest News Updates, Life History, Facts  
Mahatma Gandhi. Mohandas Karamchand Gandhi, popularly known as Mahatma...

## Information Retrieval

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# Continued...

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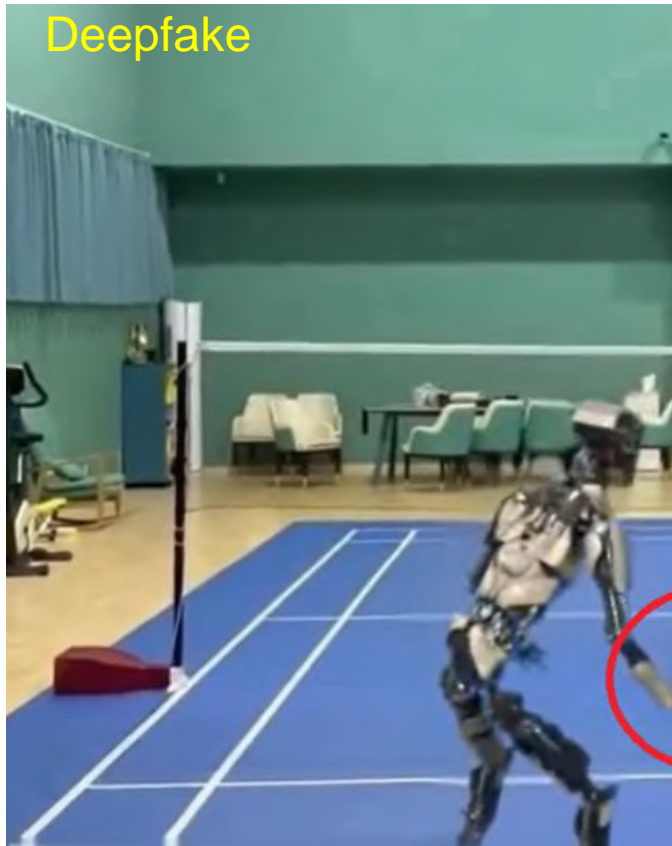
Crime Scene Investigation: TV Serial



Computer Game: Super Mario

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## Google's LaMDA, GPT-4...

Example of input text

As she said this, she looked down at her hands, and was surprised to find that she had put on one of the rabbit's little gloves while she was talking. "How can I have done that?" thought she, "I must be growing small again." She got up and went to the table to measure herself by it, and found that, as nearly as she could guess, she was now about two feet high, and was going on shrinking rapidly: so on she found out that the reason of it was the nosegay she held in her hand: she dropped it hastily, just in time to save herself from shrinking away altogether, and found that she was now only three inches high.

Tokenized Text

```
[ 'As', 'she', 'said', 'this', 'she', 'looked', 'down', 'at', 'her', 'hands', 'and', 'was', 'surprised', 'to', 'find', 'that', 'she', 'had', 'put', 'on', 'one', 'of', 'the', 'rabbit', "'s", 'little', 'gloves', 'while', 'she', 'was', 'talking', 'How', 'can', 'I', 'have', 'done', 'that', '?' 'thought', 'she', 'I', 'must', 'be', 'growing', 'small', 'again', 'She', 'got', 'up', 'and', 'went', 'to', 'the', 'table', 'to', 'measure', 'herself', 'by', 'it', 'and', 'found', 'that', 'as', 'nearly', 'as', 'she', 'could', 'guess', 'she', 'was', 'now', 'about', 'two', 'feet', 'high', 'and', 'was', 'going', 'on', 'shrinking', 'rapidly', 'soon', 'she', 'found', 'out', 'that', 'the', 'reason', 'of', 'it', 'was', 'the', 'nose', 'gay', 'she', 'held', 'in', 'her', 'hand', 'she', 'dropped', 'it', 'hastily', 'just', 'in', 'time', 'to', 'save', 'herself', 'from', 'shrinking', 'away', 'altogether', 'and', 'found', 'that', 'she', 'was', 'now', 'only', 'three', 'inches', 'high', ']
```

Embedding of the Above Text

```
[ 2.49 0.22 -0.36 -1.55 0.22 -2.45 2.65 -1.6 -0.14 2.26  
-1.26 -0.61 -0.61 -1.89 -1.87 -0.16 3.34 -2.67 0.42 -1.71  
...  
2.91 -0.77 0.13 -0.24 0.63 -0.26 2.47 -1.22 -1.67 1.63  
1.13 0.03 -0.68 0.8 1.88 3.05 -0.82 0.09 0.48 0.33]
```

Context Vector

Generative AI (Ability to generate new content): CNNs, GANs, Auto-encoders, Transformers

# Many more...

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- Stock markets and Trading
  - Credit card fraud detection
  - E-mail spam filtering
  - Language translation
  - Virtual personal assistants
  - Banking and Finance
  - Healthcare
  - Transportation and traffic prediction
  - Manufacturing industry
  - Human resource management
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Thank you!

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