

Early Foundations (1950s-1960s)

Binary Brains: Ambalika Rajendran, Favour Asu, Joseph Hiller, Misty Richardson, Zaid Tahir Jamil

Alan Turing

- Alan Turing (1912–1954) was a British mathematician, logician, and computer scientist who made significant contributions to several fields, particularly in the early development of computer science and artificial intelligence.
- He formulated the concept of the computer while tackling the challenging Entscheidungsproblem.
- He played a crucial role in breaking the Enigma code, a significant achievement during World War II that is estimated to have shortened the war and saved lives. The development of the bombe, a machine capable of decoding Enigma-encrypted messages, showcased Turing's practical contributions.



Nathan Rochester

(1919 – 2001)

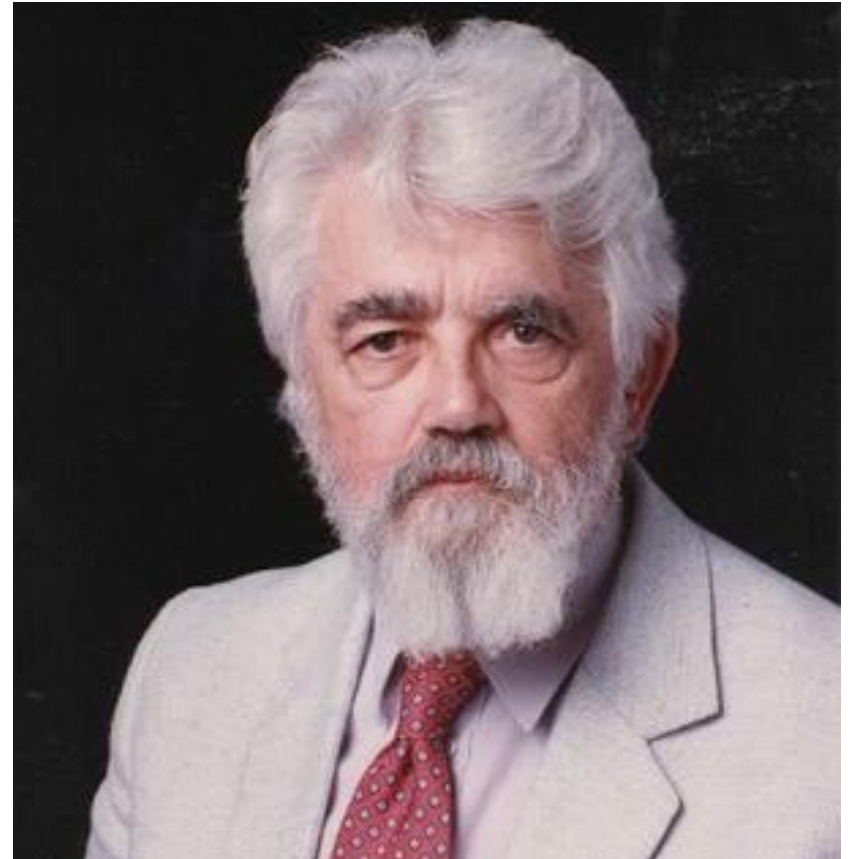
- Nathan Rochester was an American mathematician and computer scientist who was the chief architect of the IBM 701
- Rochester, along with his colleagues at IBM, played a crucial role in the creation of the **Logic Theorist**, one of the earliest AI programs.
- The Logic Theorist marked a foundational step towards the advancement of computer vision and pattern recognition technologies.



John McCarthy

(1927 – 2011)

- John McCarthy was an American computer scientist and cognitive scientist who played a pivotal role in the development of artificial intelligence (AI).
- McCarthy is best known for coining the term "**artificial intelligence**" and for his foundational work in the field.
- While McCarthy's contributions were not specifically focused on computer vision, his overarching influence in AI laid the groundwork for advancements in various subfields, including computer vision.



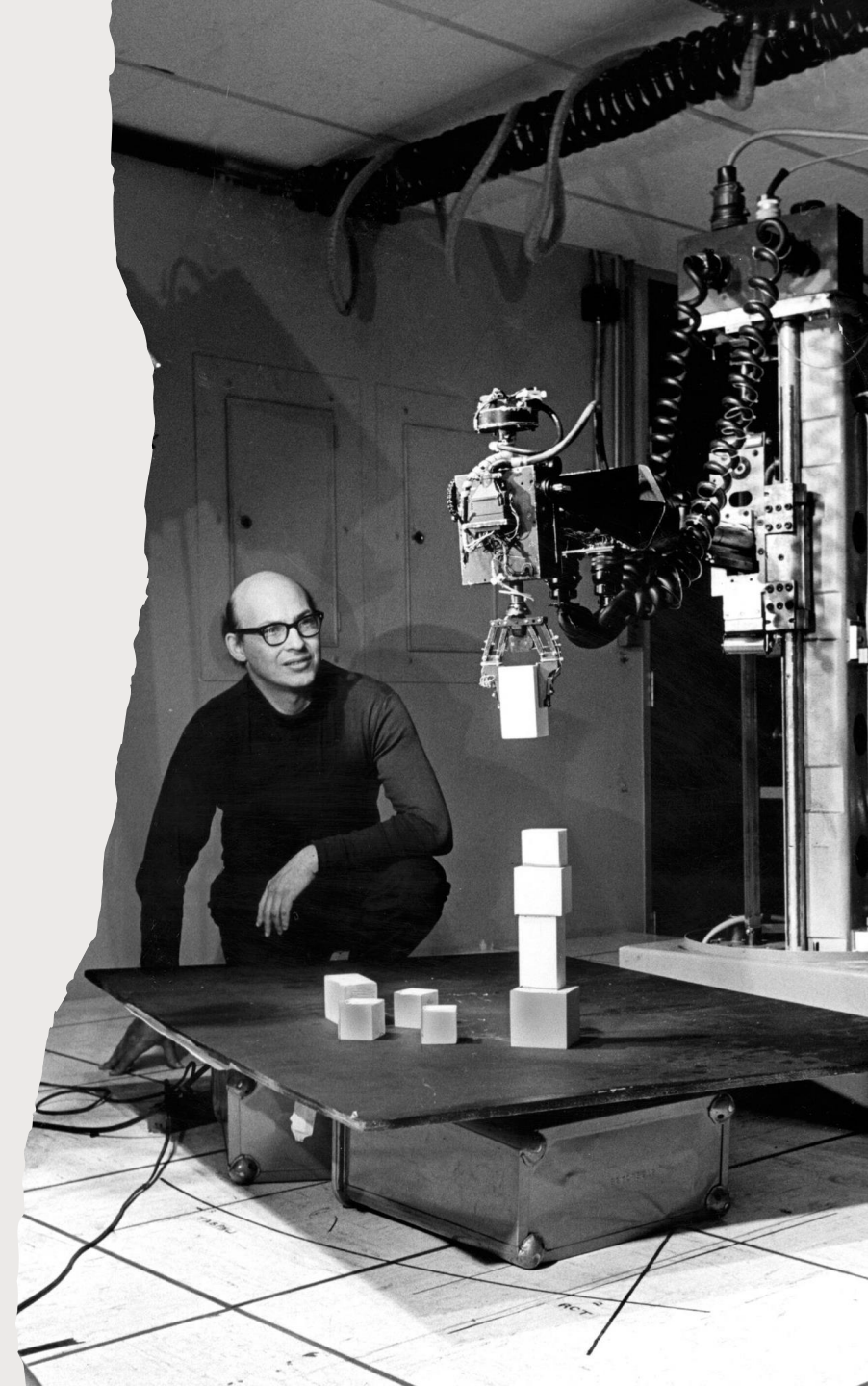
Marvin Minsky 1951 - 2016

Background:

- American mathematician and computer scientist
- One of the most famous practitioners of the science of artificial intelligence (AI)
- Winner of the 1969 Turing Award

Contributions:

- Built the first neural network simulator in 1951 (SNARC)
- Invented the confocal scanning microscope in 1959. The scanning of the illumination point in the focal plane was achieved by moving the stage.
- Co-founded the Artificial Intelligence Project (now the MIT Computer Science and Artificial Intelligence Laboratory) in 1959
- Developed pattern recognition algorithms that allowed computers to identify and classify visual patterns in images
- Designed and built some of the first visual scanners





Lawrence Roberts 1965 - 2018

Background:

- American engineer who supervised the construction of the Advanced Research Projects Agency Network (ARPANET)
- Received the Draper Prize in 2001 "for the development of the Internet"
- Known as the "father of Computer Vision"

Contributions:

- His Ph.D. thesis, 'Machine Perception of Three-Dimensional Solids,' was in the field of computer vision, and he is often referred to as the true founder of image recognition or computer vision applications
- Discussed the possibilities of extracting 3D geometrical information from 2D perspective views of blocks (polyhedra) in his Ph.D. thesis at MIT

Key Advancements

During the 1950s and 1960s, the groundwork for computer vision was laid through several key advancements:

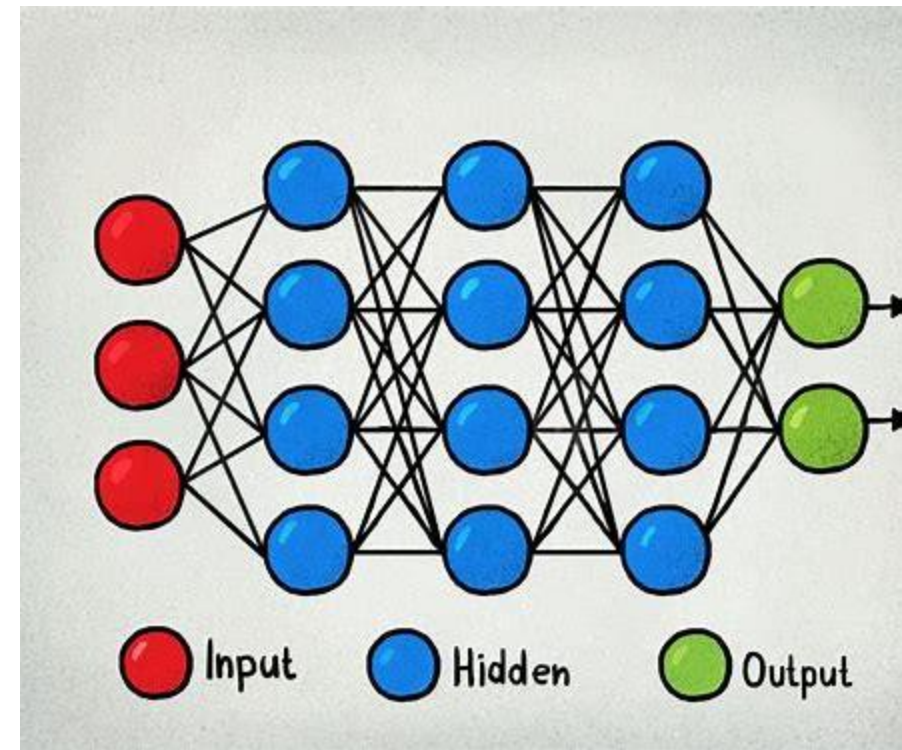
- **Neural Network Research:** Marvin Minsky and Dean Edmonds developed the Stochastic Neural Analog Reinforcement Calculator (SNARC) in 1951, an early attempt at simulating neural networks for pattern recognition.
- **Perceptron:** Frank Rosenblatt introduced the perceptron in 1957, a computational model inspired by the human neuron. This marked a significant advancement in machine learning and pattern recognition, demonstrating the potential for machines to learn and recognize patterns.
- **Pandemonium Model:** Oliver Selfridge proposed the "Pandemonium" model in 1959, a hierarchical pattern recognition system. It introduced the concept of layered processing, influencing future approaches to image analysis and feature extraction.
- **Face Recognition:** In 1960, Patrick Winston developed the "Terry" face recognition system, showcasing the potential for automated image analysis and object recognition.
- **Summer Vision Project:** Lawrence Roberts led the Summer Vision Project in 1966, a collaborative effort that accelerated advancements in image processing techniques and computer vision algorithms.
- **Vision as AI Problem:** John McCarthy and Ed Fredkin's 1968 paper emphasized the interdisciplinary nature of computer vision and its connections to artificial intelligence, cognitive science, and mathematics.

These advancements set the stage for further research and development in computer vision, laying the foundation for the field's future growth and innovation.



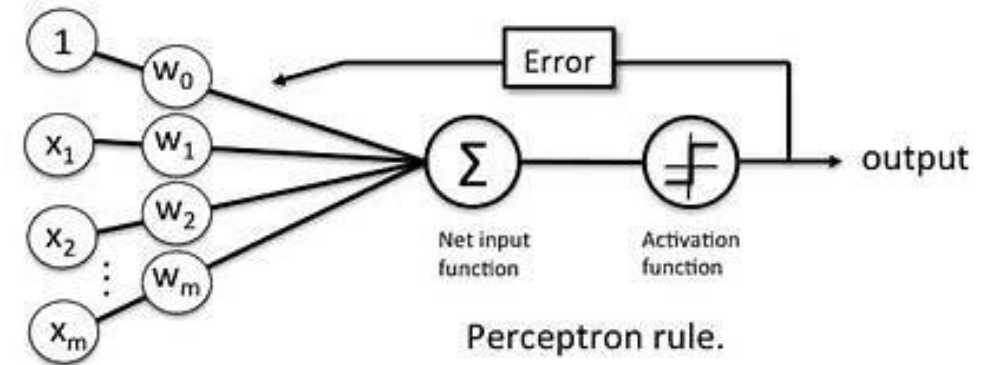
Neural Network Research

Neural networks, also known as **artificial neural networks** (ANNs) or simulated neural networks (SNNs), are a subset of machine learning and are at the heart of deep learning algorithms. Their name and structure are inspired by the human brain, mimicking the way that biological neurons signal to one another.



Perceptron

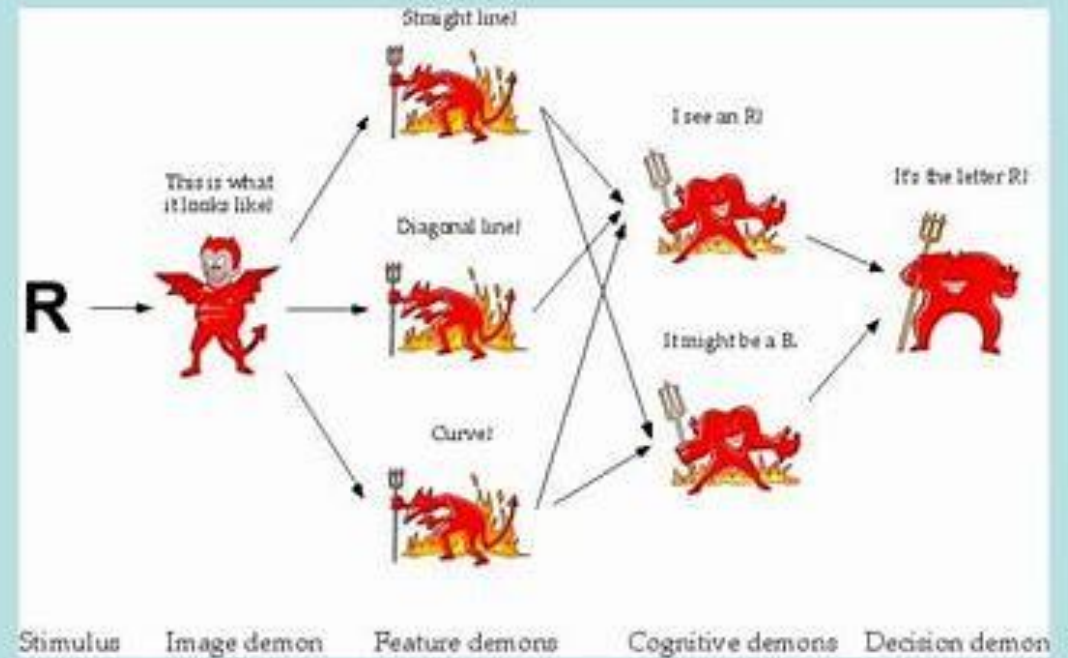
- Perceptron is one of the simplest Artificial neural network architecture. It was introduced by Frank Rosenblatt in 1957s. It is the simplest type of feedforward neural network, consisting of a single layer of input nodes that are fully connected to a layer of output nodes. It can learn the linearly separable patterns. it uses slightly different types of artificial neurons known as threshold logic units (TLU). it was first introduced by McCulloch and Walter Pitts in the 1940s.
- Types of Perceptron
- **Single-Layer Perceptron:** This type of perceptron is limited to learning linearly separable patterns. effective for tasks where the data can be divided into distinct categories through a straight line.
- **Multilayer Perceptron:** Multilayer perceptrons possess enhanced processing capabilities as they consist of two or more layers, adept at handling more complex patterns and relationships within the data.



Pandemonium Model

- **Pandemonium architecture** is a theory in cognitive science that describes how visual images are processed by the brain. It has applications in artificial intelligence and pattern recognition. The theory was developed by the artificial intelligence pioneer Oliver Selfridge in 1959. It describes the process of object recognition as a hierarchical system of detection and association by a metaphorical set of "demons" sending signals to each other. This model is now recognized as the basis of visual perception in cognitive science.

The pandemonium model of feature detection



But no top-down influence.



FACE
RECOGNITION

Face Recognition

- Face recognition is a type of computer vision that uses optical input to analyze an image—in this case, it looks particularly at faces that appear in the image. Facial recognition technology can be used as a building block to support other capabilities like face identification, grouping, and verification

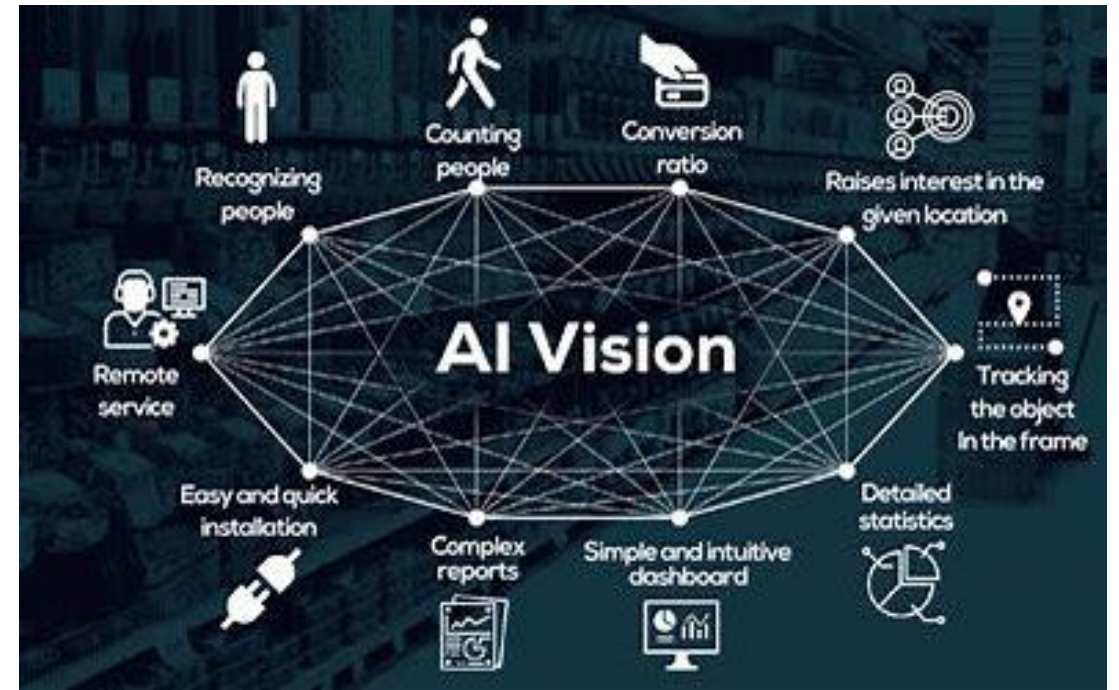
Summer vision project

- Lawrence Roberts led the Summer Vision Project in 1966, a collaborative effort that accelerated advancements in image processing techniques and computer vision algorithms.



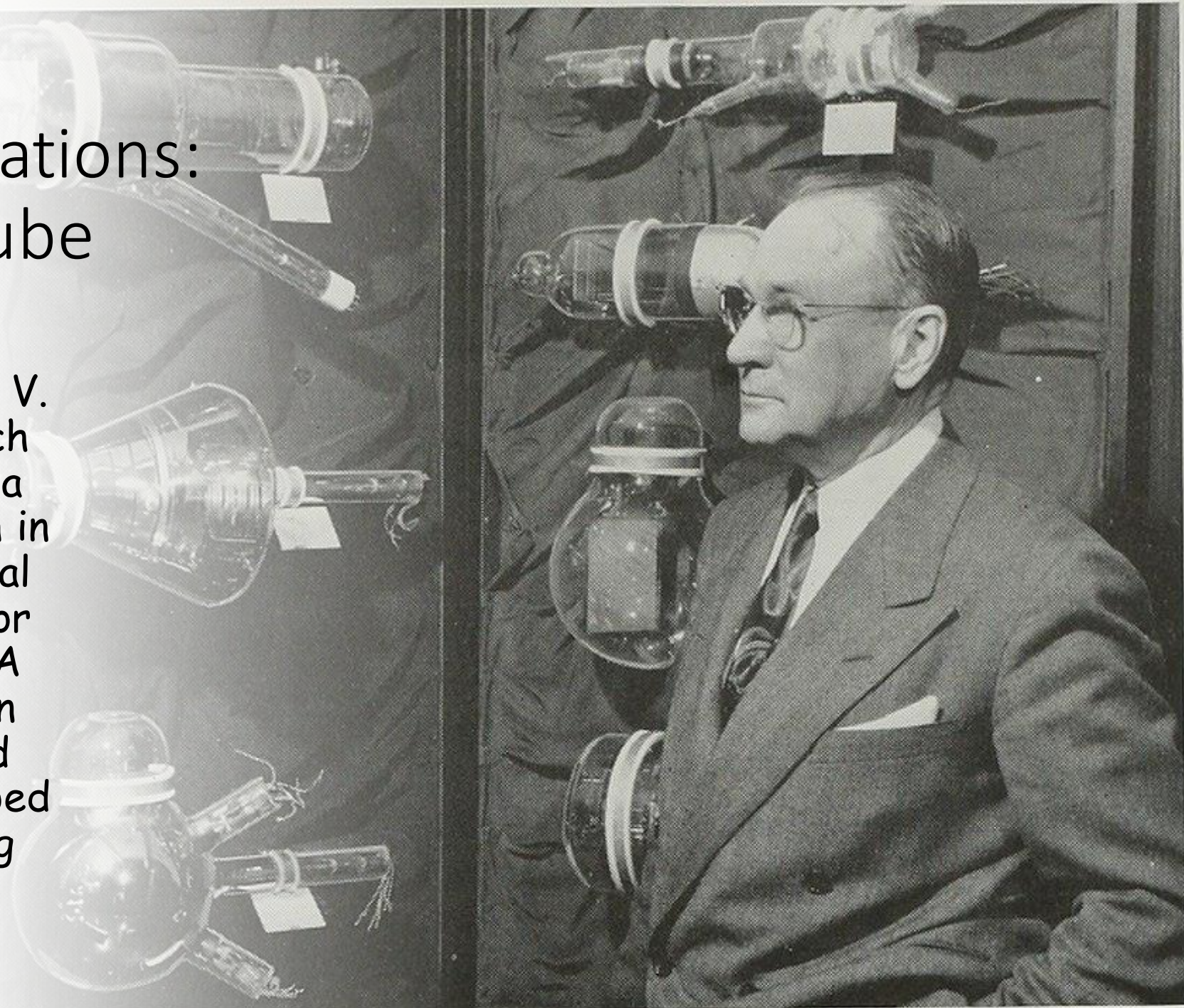
Vision as AI Problem

- Vision AI (also known as Computer Vision) is a field of computer science that trains computers to replicate the human vision system. This enables digital devices (like face detectors, QR Code Scanners) to identify and process objects in images and videos, just like humans do.
- Personalized image search on eCommerce stores, 3D model building (Photogrammetry), aerial images on a map, OCR scanning in retail outlets, face recognition, image detectors, MRI reconstruction are some of the innovative use cases of computer vision that we have today.



Impactful applications: 1950- Vidicon Tube

RCA and P. K. Weimer, S. V. Forgue and R. R. Goodrich introduce Vidicon tube, a video camera tube design in which the target material is a photoconductor. Prior to the late 1970s, NASA used Vidicon cameras on most of their unmanned deep space probes equipped with the remote sensing ability.

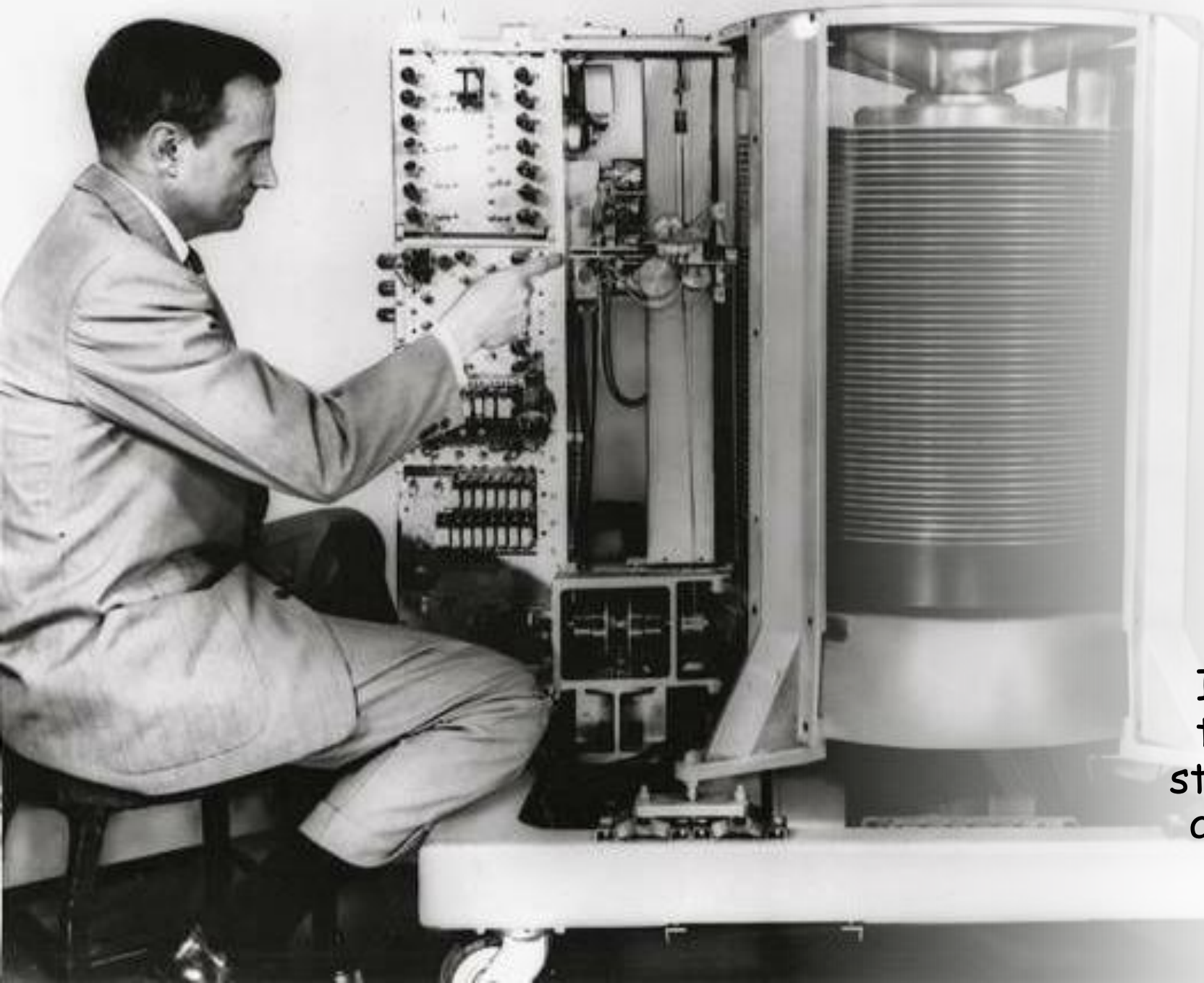


Impactful applications: 1951- 1st AI program

The 1st ever AI program
ever written was a checkers
playing program.

The program was written by
Arthur Samuel.



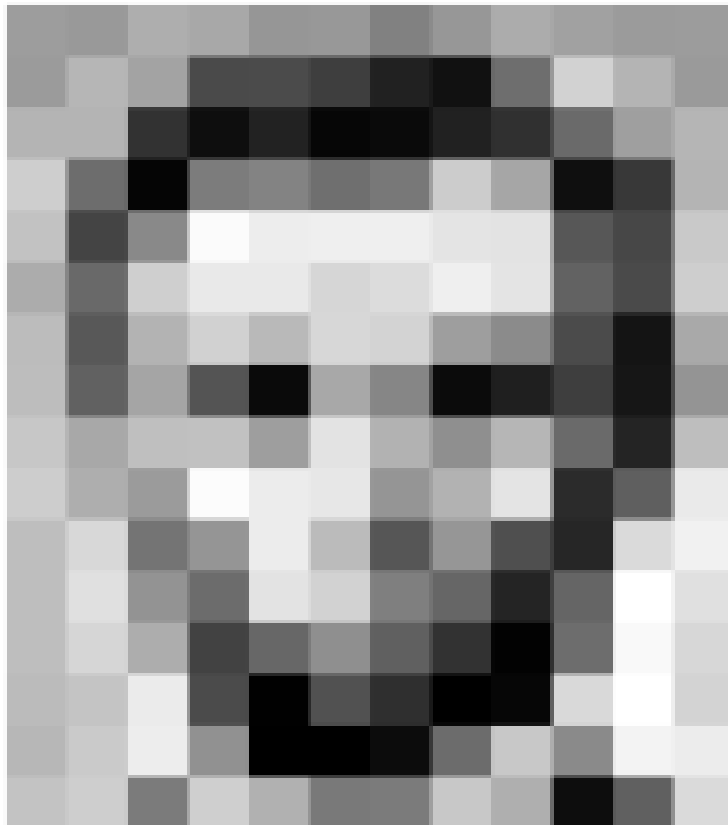


Impactful
applications:
1953-
1st hard drive

In 1956 IBM introduced
their 1st magnetic data-
storage systems but it was
actually invented in 1953

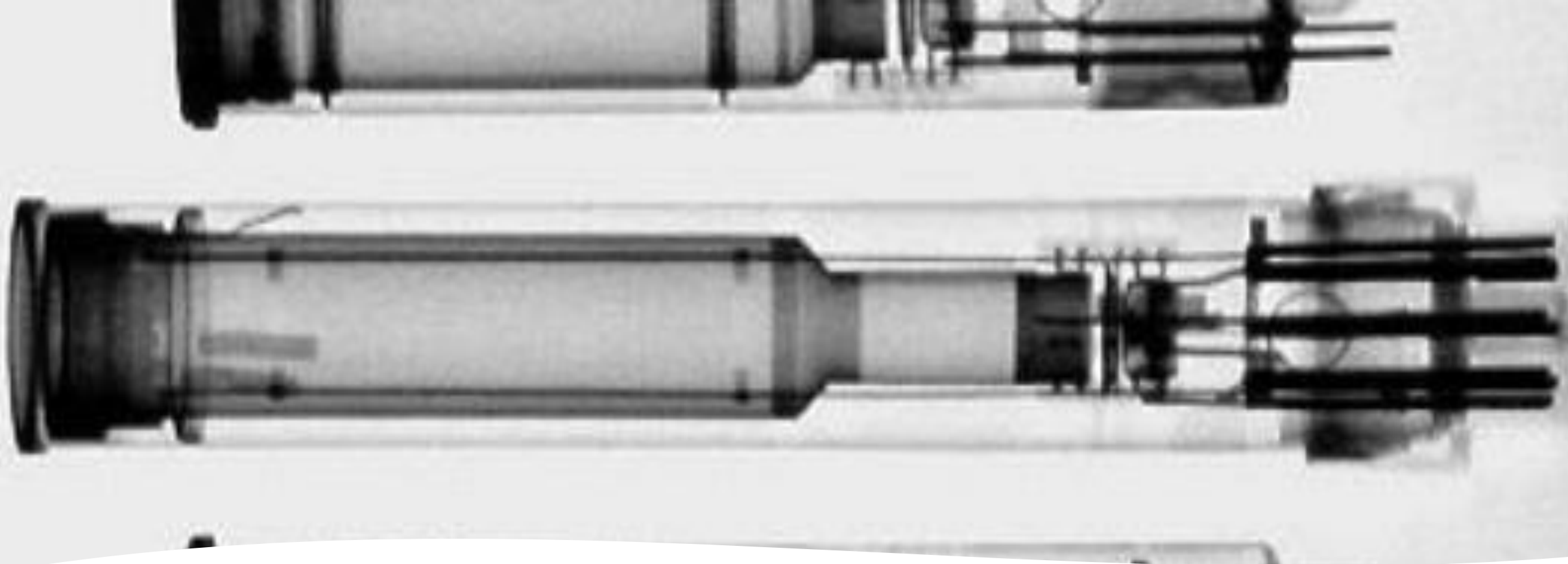
Impactful applications: 1959- 1st digital scanner

The first digital image scanner was invented by transforming images into grids of numbers.



157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	165	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	216	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	105	36	190
205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	236	187	85	150	79	38	218	241
190	234	147	108	227	210	127	102	36	101	255	234
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

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190	216	116	149	236	187	85	150	79	38	218	241
190	234	147	108	227	210	127	102	36	101	255	234
190	214	173	66	103	143	96	50	2	109	249	215
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195	206	123	207	177	121	123	200	175	13	96	218



Impactful applications:
1960- Plumbicon

To offer more image stability Philips introduces
the Plumbicon.

Plumbicons were used in x-rays, tv's, and cameras

Dec. 5, 1967

F. M. WANLASS

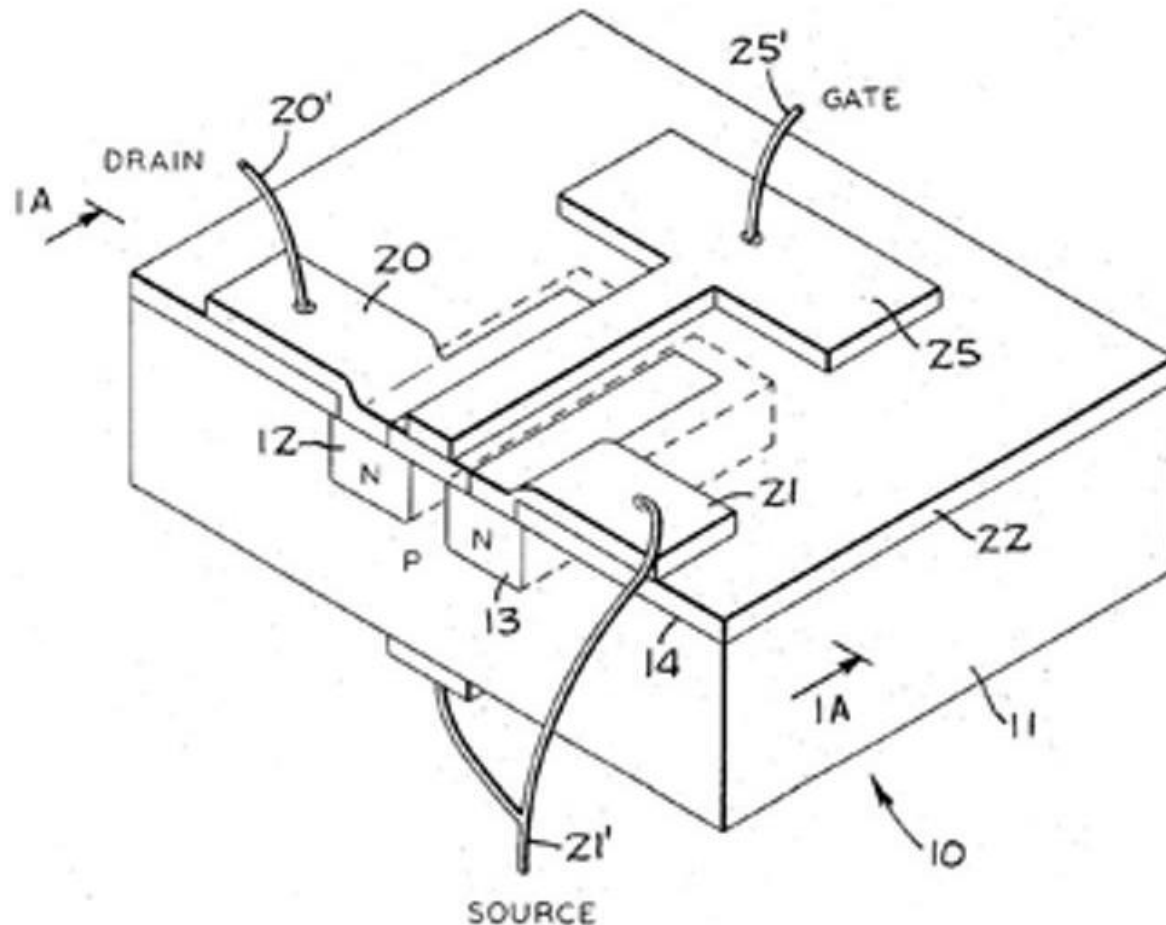
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LOW STAND-BY POWER COMPLEMENTARY FIELD EFFECT CIRCUITRY

Filed June 18, 1963

5 Sheets-Sheet 1

Fig. 1

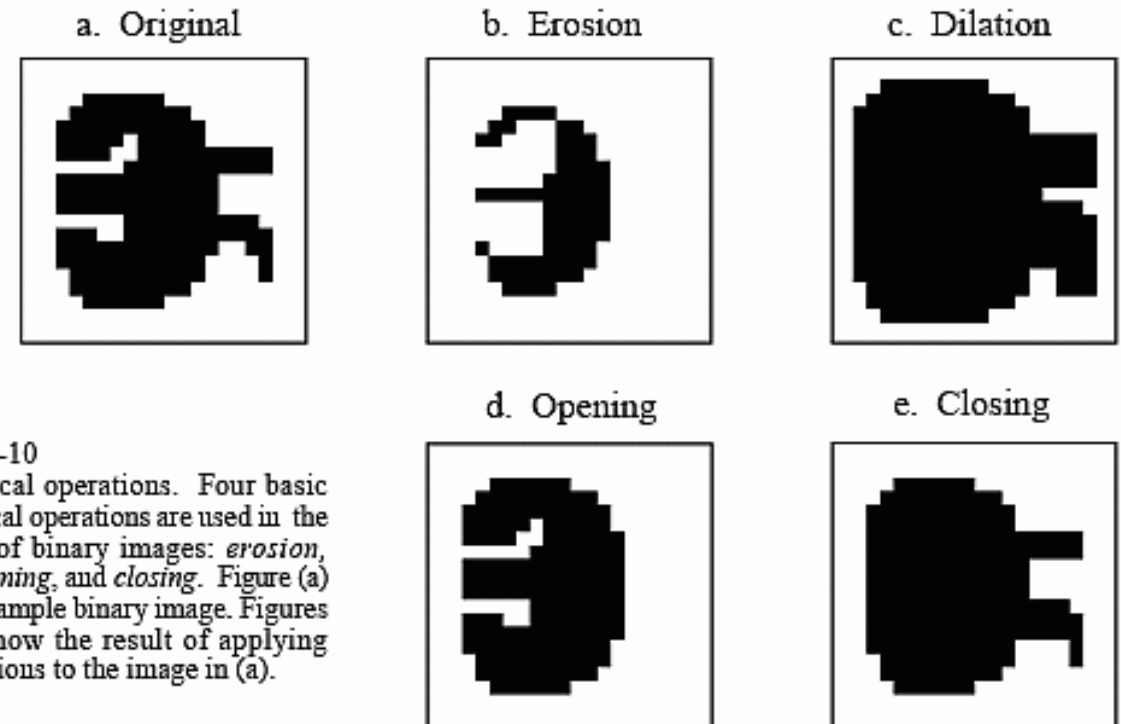


Impactful applications:
1963- CMOS invented

Frank Wanlass, American electrical engineer patents CMOS (complementary metal-oxide-semiconductor) logic circuits used in digital logic circuits as well as analog circuits like CMOS image sensors.

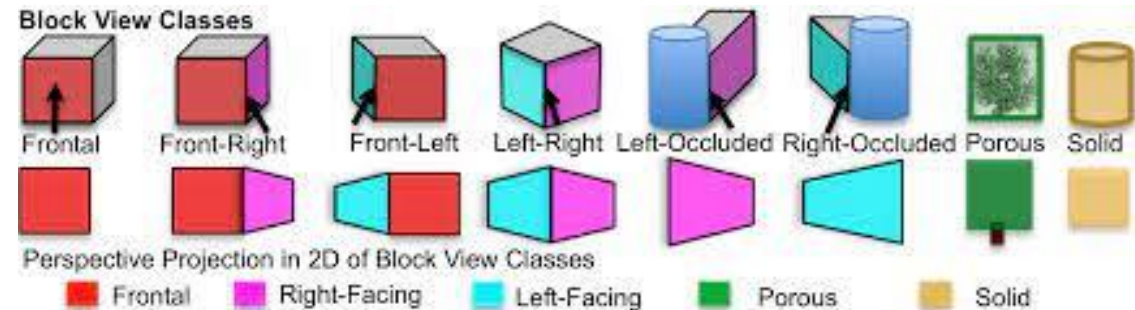
Impactful Applications: 1964

Morphological Image Processing



Block World & Early Shape Representation

- The concept of "Block World" and early shape representation in the field of computer vision was introduced by Lawrence G. Roberts in the 1960s.
- The Block World model aimed to represent objects in a scene using simple geometric shapes, providing a foundational approach to early attempts at computer-based vision and object recognition.



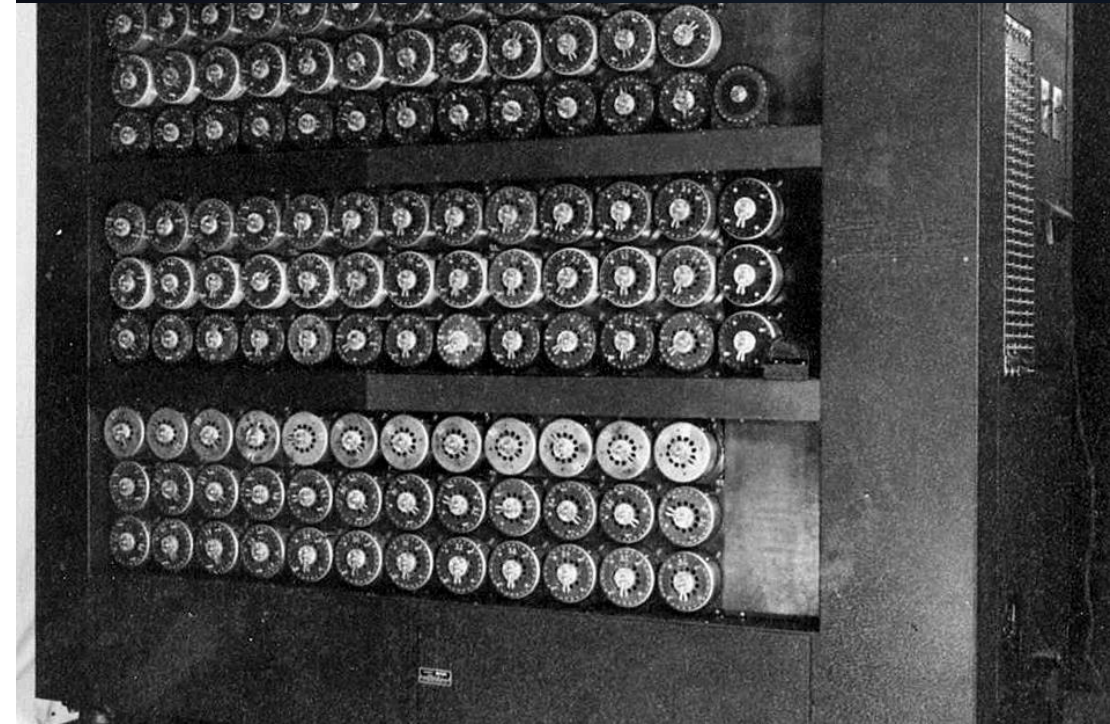


Impactful applications: 1969- CCD invented

CCD, or charged-couple device is invented at American Bell Laboratories by William Boyle and George E. Smith, allowing for the transfer of a charge along the surface of a semiconductor from one storage capacitor to the next - a major contribution to digital imaging.

Turing's Codebreaking during World War II

- Turing played an important role in breaking the Enigma code, a significant achievement during World War II that is estimated to have shortened the war and saved lives.
- He development of the bombe machine. It was an electromechanical device, which capable of decoding Enigma-encrypted messages.



Turing Test

- **Human Judge Interaction** - In the Turing Test, a human judge interacts with both a machine and a human, without knowing which is which.
- **Conversational Performance**: - The machine's goal is to engage in a conversation that is indistinguishable from a human. If the judge cannot reliably differentiate between the machine and the human based on their responses, the machine is considered to have passed the Turing Test.
- **Criterion for Intelligence**: The Turing Test serves as a benchmark for artificial intelligence, suggesting that a machine demonstrating human-like conversational abilities can be considered intelligent, at least in a linguistic context. The test does not assess other aspects of intelligence but focuses on the ability to emulate human-like dialogue effectively.

