Το μέλλον του AI: Τι αναμένουμε να γίνει καλύτερο, φθηνότερο, πιο αποδοτικό ενεργειακά

Χάρης Γεωργίου (MSc, PhD)

Ένωση Πληροφορικών Ελλάδας

Στόχοι:

- Πρώτος "καθολικός" φορέας εκπροσώπησης πτυχιούχων Πληροφορικής.
- Αρμόδιος φορέας εκπροσώπησης επαγγελματιών Πληροφορικής.
- Αρμόδιος επιστημονικός "συμβουλευτικός" φορέας για το Δημόσιο.
- Αρωγός της Εθνικής Ψηφιακής Στρατηγικής & Παιδείας της χώρας.

https://www.epe.org.gr

Τομείς παρέμβασης

Ποιοι είναι οι κύριοι τομείς παρεμβάσεων της ΕΠΕ;

1. Εθνική Ψηφιακή Στρατηγική & Οικονομία
2. Εργασιακά (ΤΠΕ), Δημόσιος & ιδιωτικός τομέας
3. Παιδεία (Α′, Β′, Γ′)
4. Έρευνα & Τεχνολογία
5. Έργα & υπηρεσίες ΤΠΕ
6. Ασφάλεια συστημάτων & δεδομένων
7. Ανοικτά συστήματα & πρότυπα
8. Χρήση ΕΛ/ΛΑΚ
9. Πνευματικά δικαιώματα
10. Κώδικας Δεοντολογίας (ΤΠΕ)
11. Κοινωνική μέριμνα (ICT4D)

Harris Georgiou (MSc, PhD) – https://github.com/xgeorgio/info

- R&D: Associate post-doc researcher and lecturer with the University Athens (NKUA) and University of Piraeus (UniPi)
- Consultant in Medical Imaging, Machine Learning, Data Analytics, Signal Processing, Process Optimization, Dynamic Systems, Complexity & Emergent A.I., Game Theory
- HRTA member since 2009, LEAR / scientific advisor
- HRTA field operator (USAR, scuba diver)
- Wilderness first aid, paediatric (child/infant)
- Humanitarian aid & disaster relief in Ghana, Lesvos, Piraeus
- Support of unaccomp. minors, teacher in community schools
- Streetwork training, psychological first aid & victim support
- 2+4 books, 200+ scientific papers/articles (and 6 marathons)

Επισκόπηση

- Περιεχόμενα:
  - Μέρος Ι: Τεχνητή Νοημοσύνη – Βασικές Έννοιες
  - Μέρος ΙΙ: Μελλοντικές Προοπτικές

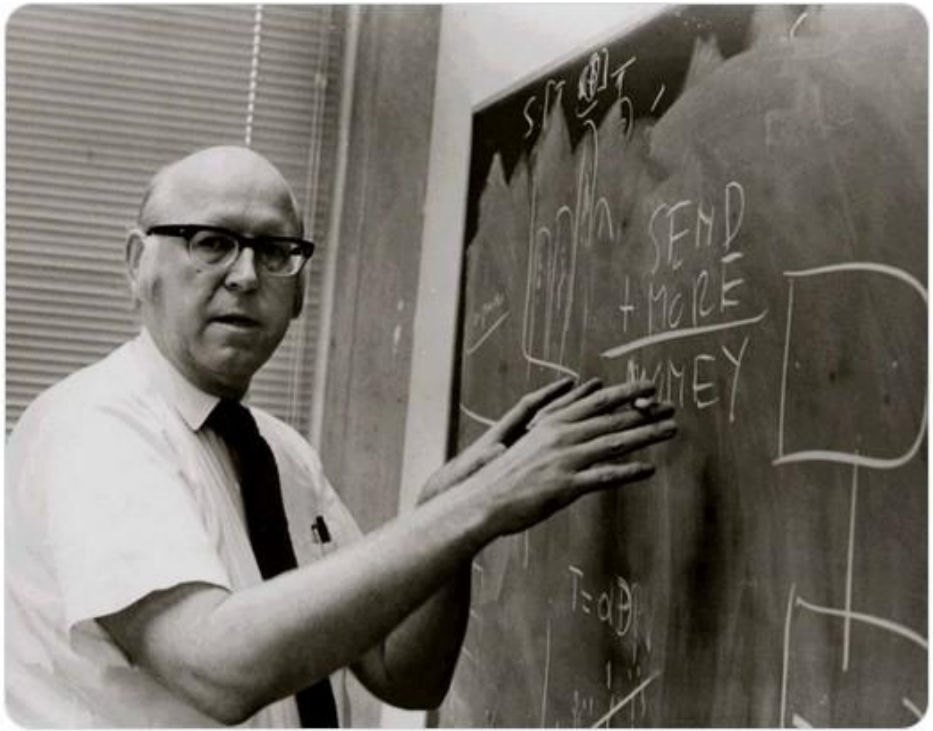
- Σχετικό υλικό:
  - «Turing machines explained visually» – https://www.youtube.com/watch?v=-ZS_zFg4w5k
  - «Game of life: computer with display» – https://www.youtube.com/watch?v=WfuhbI8HE7s
  - Computer History Museum (CHM) – https://www.youtube.com/@ComputerHistory
  - «Artificial Intelligence | 60 Minutes Full Episodes» – https://www.youtube.com/watch?v=aZ5EsdnpLMI
  - «Queens puzzle solver in LISP», @ApneaCoding – https://youtu.be/_1CRCyklUto
  - «BAM neural network in Arduino», @ApneaCoding – https://youtu.be/RkM-rpSVD4I

Μέρος Ι: Τεχνητή Νοημοσύνη – Βασικές Έννοιες

1. Τι είναι;
2. Γιατί μας ενδιαφέρει;
3. Ποιος τη σχεδιάζει-δημιουργεί;
4. Νοημοσύνη στη Φύση

MIT CSAIL @MIT_CSAIL · 13h

Born #otd in 1927: Allen Newell, who in 1955 — before the term "AI" even existed — co-wrote what's widely considered the world's first AI program, Logic Theorist. This work proved 38 out of 52 classic math theorems.



MEMORANDUM
RM-3739-RC
JUNE 1963

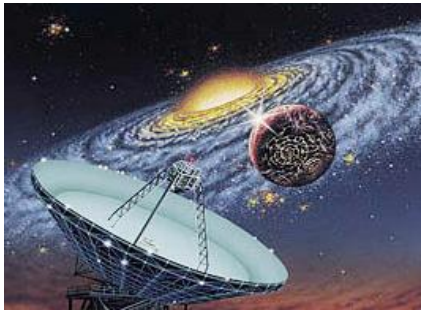
IPL-V PROGRAMMERS' REFERENCE MANUAL

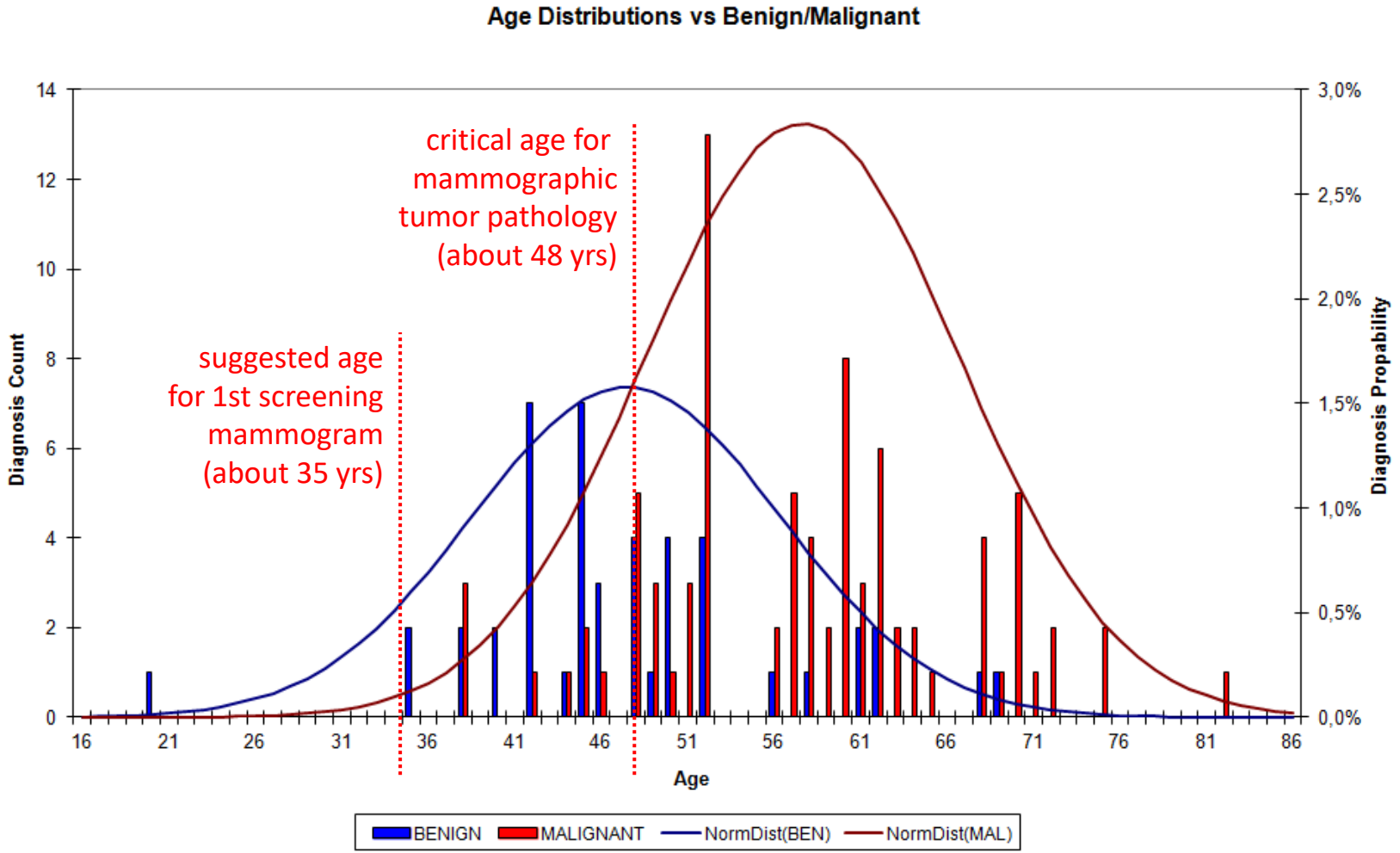
Edited by Allen Newell

The RAND Corporation

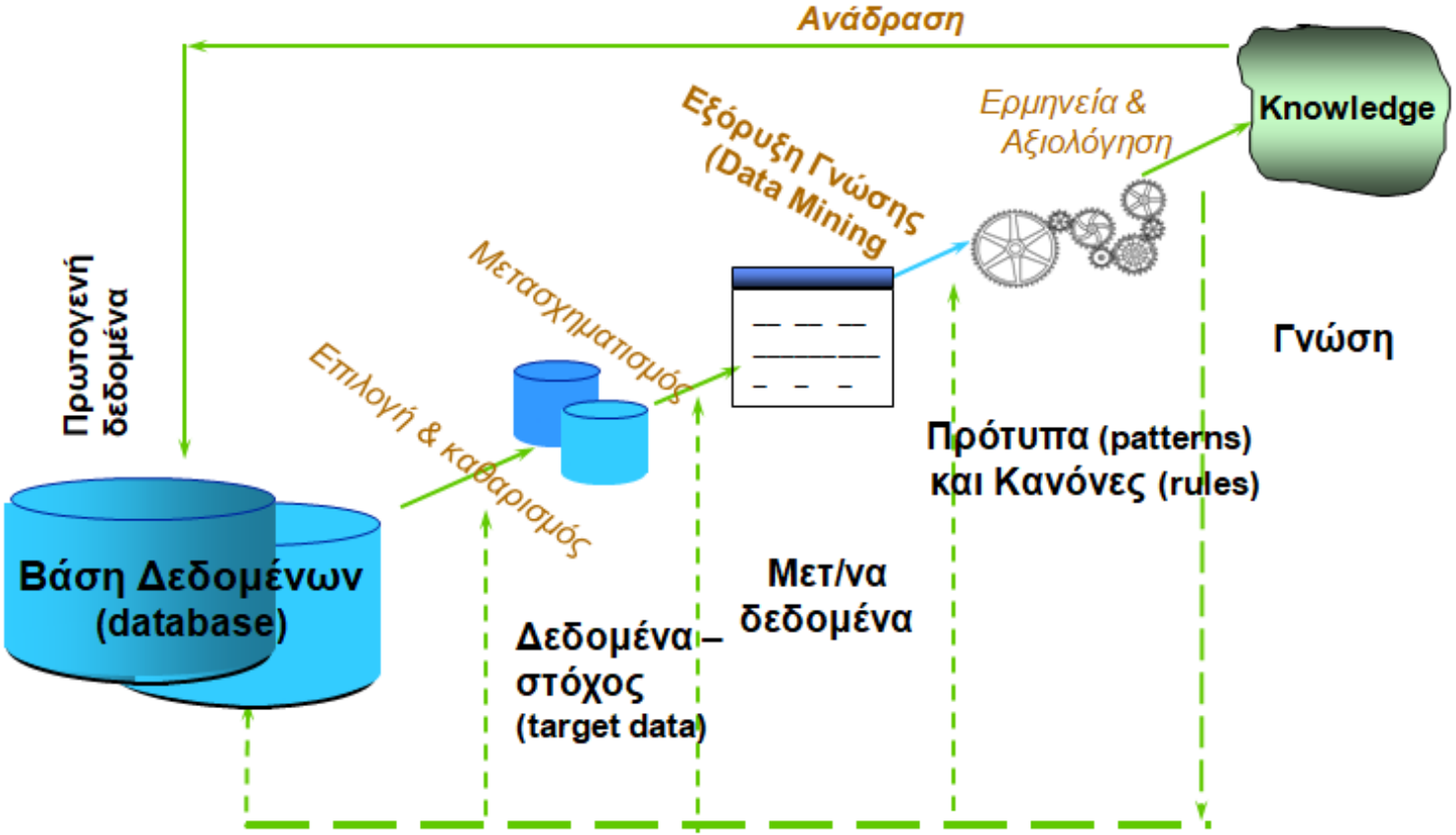
Δεδομένα παντού ...

- Παράγονται όλο και περισσότερα δεδομένα:
  - Τραπεζικά, τηλεπικοινωνιακά, ...
  - Επιστημονικά δεδομένα: αστρονομικά, βιολογικά κλπ.
  - Κείμενα στο web κ.α.
- Αποθηκεύονται όλο και περισσότερα δεδομένα:
  - Γρήγορη / φθηνή τεχνολογία αποθήκευσης
  - Ικανά ΣΔΒΔ για μεγάλες ΒΔ



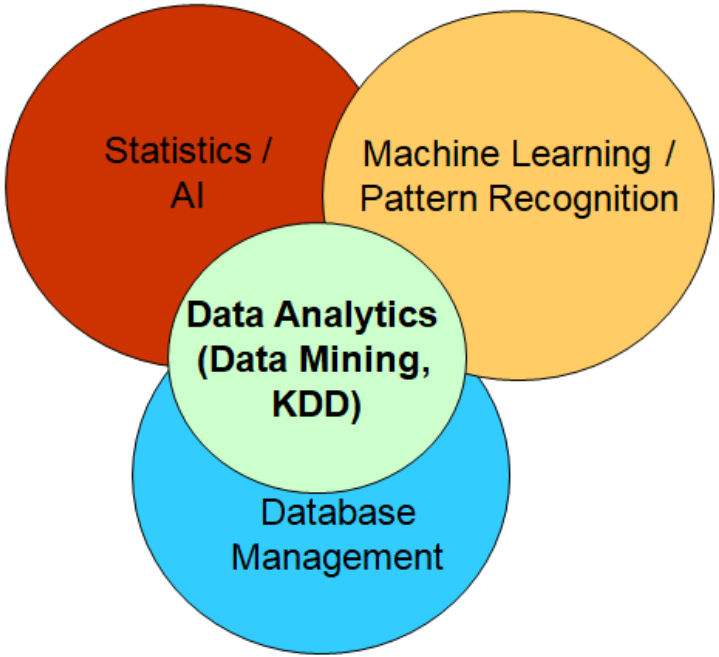

Age Distributions vs Benign/Malignant
critical age for mammographic tumor pathology (about 48 yrs)
suggested age for 1st screening mammogram (about 35 yrs)
Diagnosis Count
Diagnosis Propability
Age
BENIGN
MALIGNANT
NormDist(BEN)
NormDist(MAL)

Η “σκάλα” της διαδικασίας KDD

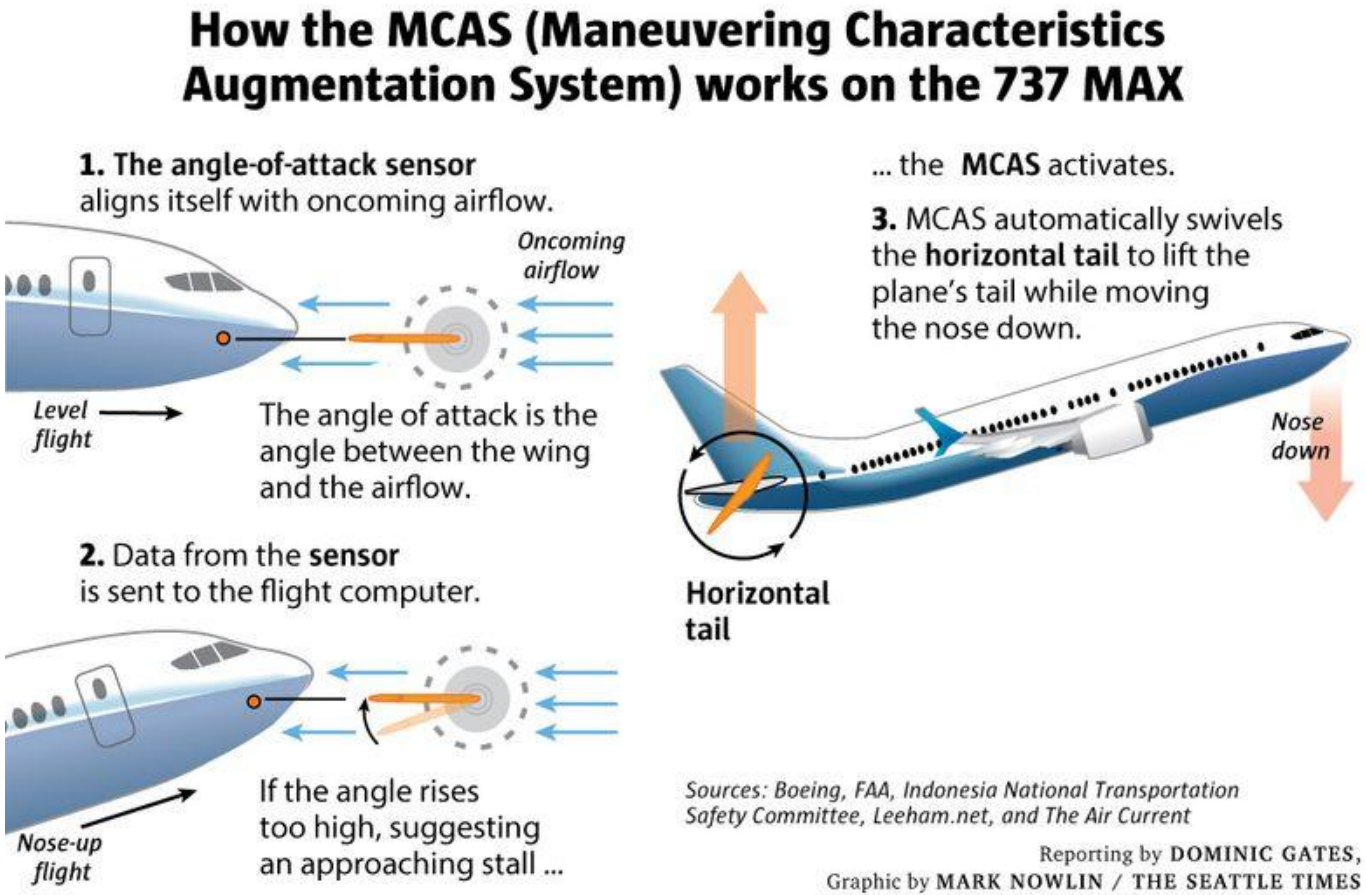


Σχετικά επιστημονικά πεδία

- Στατιστική / *«Τεχνητή Νοημοσύνη»*, Μηχανική Μάθηση / Αναγνώριση Προτύπων, Διαχείριση Βάσεων Δεδομένων
- Οι παραδοσιακές τεχνικές επεξεργασίας δεδομένων που μας προσφέρουν αυτές οι επιστημονικές περιοχές μπορεί να είναι ανεφάρμοστες λόγω:
  - του μεγάλου όγκου,
  - των πολλών διαστάσεων,
  - της ετερογένειας των δεδομένων,
  - των απαιτήσεων επεξεργασίας,
  - ...



Worst Software Failures: Boeing 737 MAX



Source: https://www.seattletimes.com/seattle-news/times-watchdog/the-inside-story-of-mcas-how-boeings-737-max-system-gained-power-and-lost-safeguards/

Worst Software Failures: Tesla car crash

PRELIMINARY REPORT

HIGHWAY

The information in this preliminary report is
It will be supplemented or corrected d

On Friday, March 23, 2018, about 9:27 a.m., Paci
electric-powered passenger vehicle, occupied by
US Highway 101 (US-101) in Mountain View, S
approached the US-101/State Highway (SH-85) i
from the left, which was a high-occupancy-vehicl

According to performance data downloaded from
driver assistance features traffic-aware cruise cont
Tesla refers to as "autopilot." As the Tesla approac
lanes of US-101 from the SH-85 exit ramp, it mo
Tesla continued traveling through the gore area an
at a speed of about 71 mph.[2] The crash attenuato
barrier. The speed limit on this area of roadway is
the traffic-aware cruise control speed was set to
rotated the Tesla counterclockwise and caused a se
Tesla was involved in subsequent collisions with
Audi A4 (see figure 1).

A preliminary review of the recorded performance data showed the following:

- The Autopilot system was engaged on four separate occasions during the 32-minute trip, including a continuous operation for the last 18 minutes 55 seconds prior to the crash.
- During the 18-minute 55-second segment, the vehicle provided two visual alerts and one auditory alert for the driver to place his hands on the steering wheel. These alerts were made more than 15 minutes prior to the crash.
- During the 60 seconds prior to the crash, the driver's hands were detected on the steering wheel on three separate occasions, for a total of 34 seconds; for the last 6 seconds prior to the crash, the vehicle did not detect the driver's hands on the steering wheel.
- At 8 seconds prior to the crash, the Tesla was following a lead vehicle and was traveling about 65 mph.
- At 7 seconds prior to the crash, the Tesla began a left steering movement while following a lead vehicle.
- At 4 seconds prior to the crash, the Tesla was no longer following a lead vehicle.
- At 3 seconds prior to the crash and up to the time of impact with the crash attenuator, the Tesla's speed increased from 62 to 70.8 mph, with no precrash braking or evasive steering movement detected.

The New Caledonian crow uses twigs and branches to extricate grubs and insects from inside trees (Credit: Alamy)

Source: BBC

Philos Trans R Soc Lond B Biol Sci. 2007 Feb 12;362(1480):587–602. doi: 10.1098/rstb.2006.1997

Dolphin social intelligence: complex alliance relationships in bottlenose dolphins and a consideration of selective environments for extreme brain size evolution in mammals

Richard C Connor [1,*]

Author information · Article notes · Copyright and License information

PMCID: PMC2346519 PMID: 17296597

Abstract

Bottlenose dolphins in Shark Bay, Australia, live in a large, unbounded society with a fission–fusion grouping pattern. Potential cognitive demands include the need to develop social strategies involving the recognition of a large number of individuals and their relationships with others. Patterns of alliance affiliation among males may be more complex than are currently known for any non-human, with individuals participating in 2–3 levels of shifting alliances. Males mediate alliance relationships with gentle contact behaviours such as petting, but synchrony also plays an important role in affiliative interactions. In general, selection for social intelligence in the context of shifting alliances will depend on the extent to which there are strategic options and risk. Extreme brain size evolution may have occurred more than once in the toothed whales, reaching peaks in the

Octopuses Capable of Hand-Eye Coordination

By Helen Albert, CosmosMagazine.com
May 30, 2011

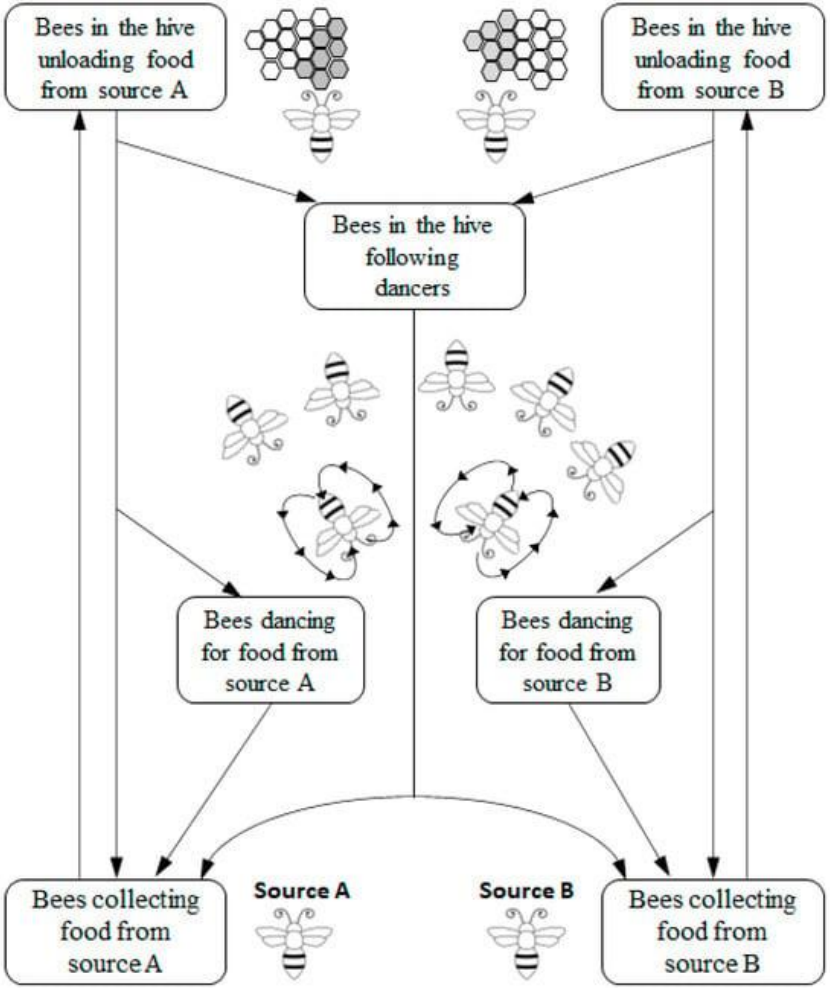
LONDON: Octopuses are able to use visual cues to guide a single arm to a location, a complex movement that was not thought possible due to their lack of a rigid body structure, say researchers.

The octopus' arm is made up primarily of muscle with no skeletal support, so octopuses were previously believed to have a low level of body awareness and only limited control over their limbs. However, this study has shown for the first time that they can direct a single arm in a complex movement to a target location.

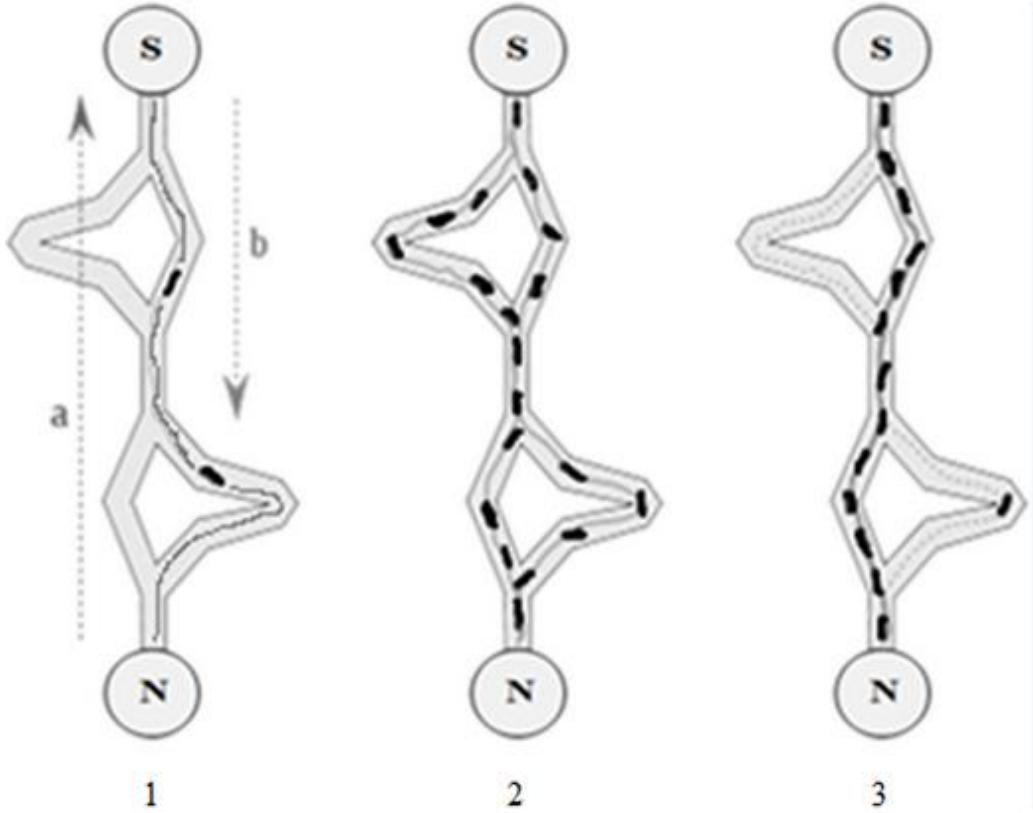
"Octopuses have a central nervous system that is advanced for an invertebrate, but simple compared to a vertebrate, yet it is capable of controlling a much more 'difficult' arm," said lead study author Tamar Gutnick, a researcher at the Hebrew University of Jerusalem in Israel.

"Because of the unique body plan of the octopus its ability to control a single arm in a complex movement is quite amazing."

Bee Colony Optimization (ACO)



Ant Colony Optimization (ACO)



Swarm Intelligence (SI)

ELSEVIER

International Journal of Information Management Data Insights

Volume 2, Issue 2, November 2022, 100086

Particle swarm optimization and RBF neural networks for public transport arrival time prediction using GTFS data

Eva Chondrodima [a], Harris Georgiou [a], Nikos Pelekis [b], Yannis Theodoridis [a]

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https://doi.org/10.1016/j.jjimei.2022.100086

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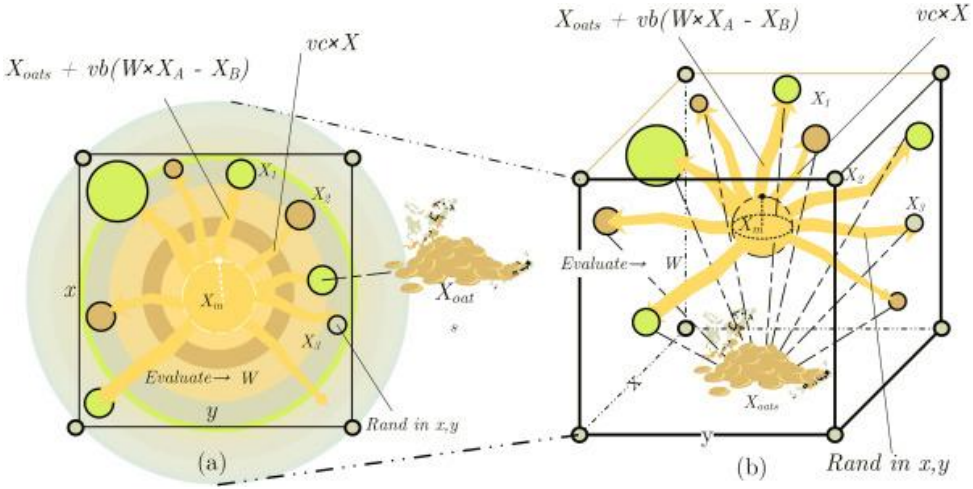
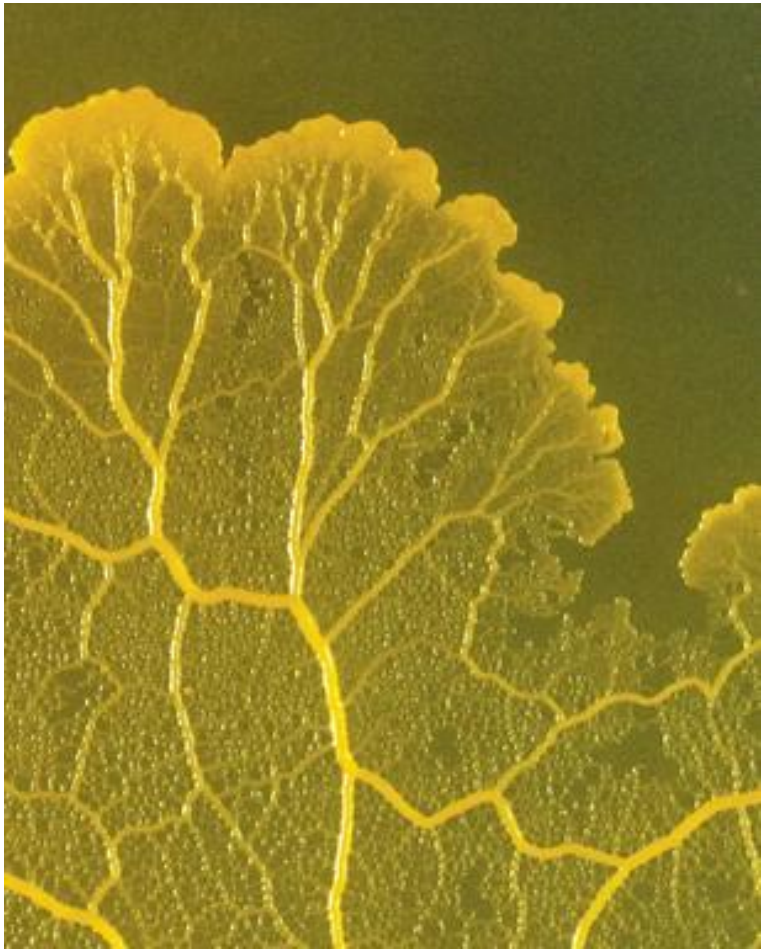
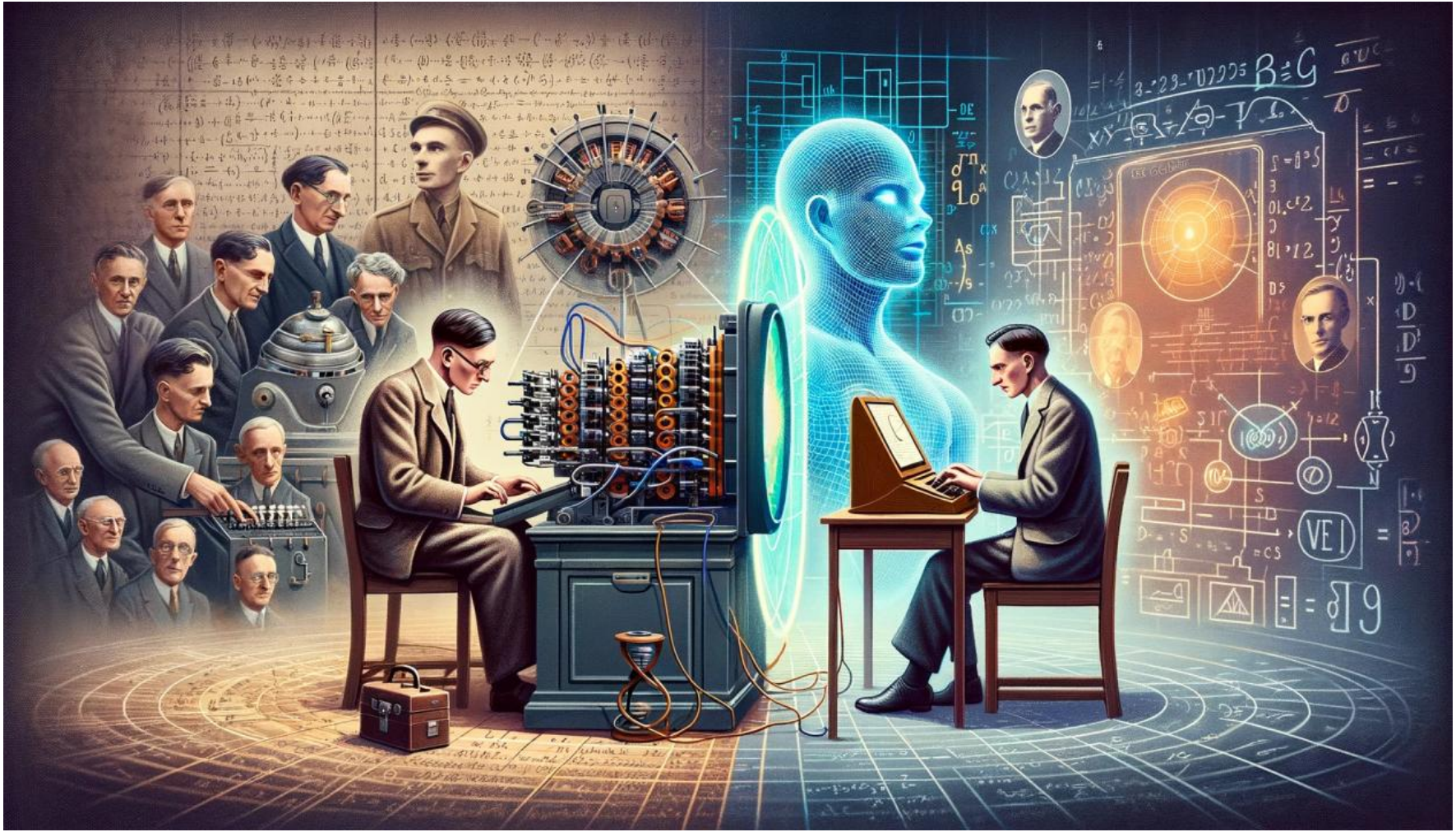
Future Generation Computer Systems
Volume 111, October 2020, Pages 300-323

Slime mould algorithm: A new method for stochastic optimization

Shimin Li [a], Huiling Chen [a], Mingjing Wang [e], Ali Asghar Heidari [b c], Seyedali Mirjalili [d]







Μέρος ΙΙ: Μελλοντικές προοπτικές

1. Turing Completeness
2. Προσομοιώνοντας τη Φύση
3. Τι έρχεται στο μέλλον;
4. Πως θα τα καταφέρουμε;

What Does Turing Complete Mean?

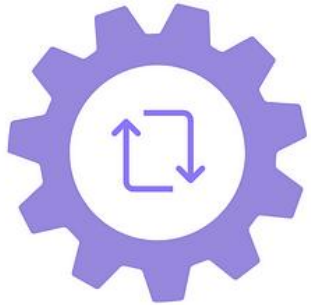
Key characteristics that define a Turing complete system

Sequence

Execute a series of computational steps in the order they are provided.

Conditionals

Execute different computational paths conditionally based on certain criteria.



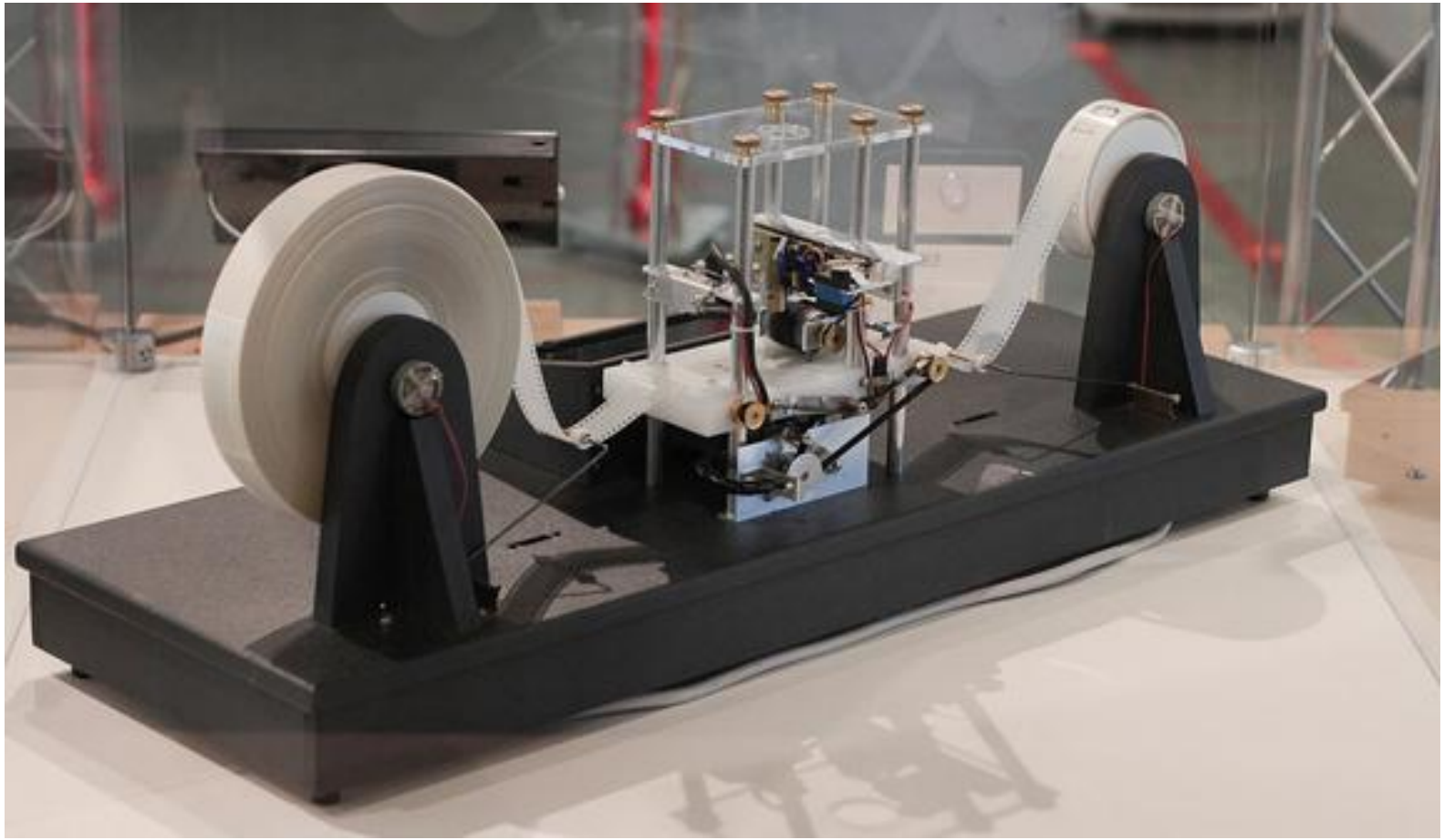
Iteration

Repeat computational sub-processes over and over.

Store Data

Store intermediate results for later use in memory.

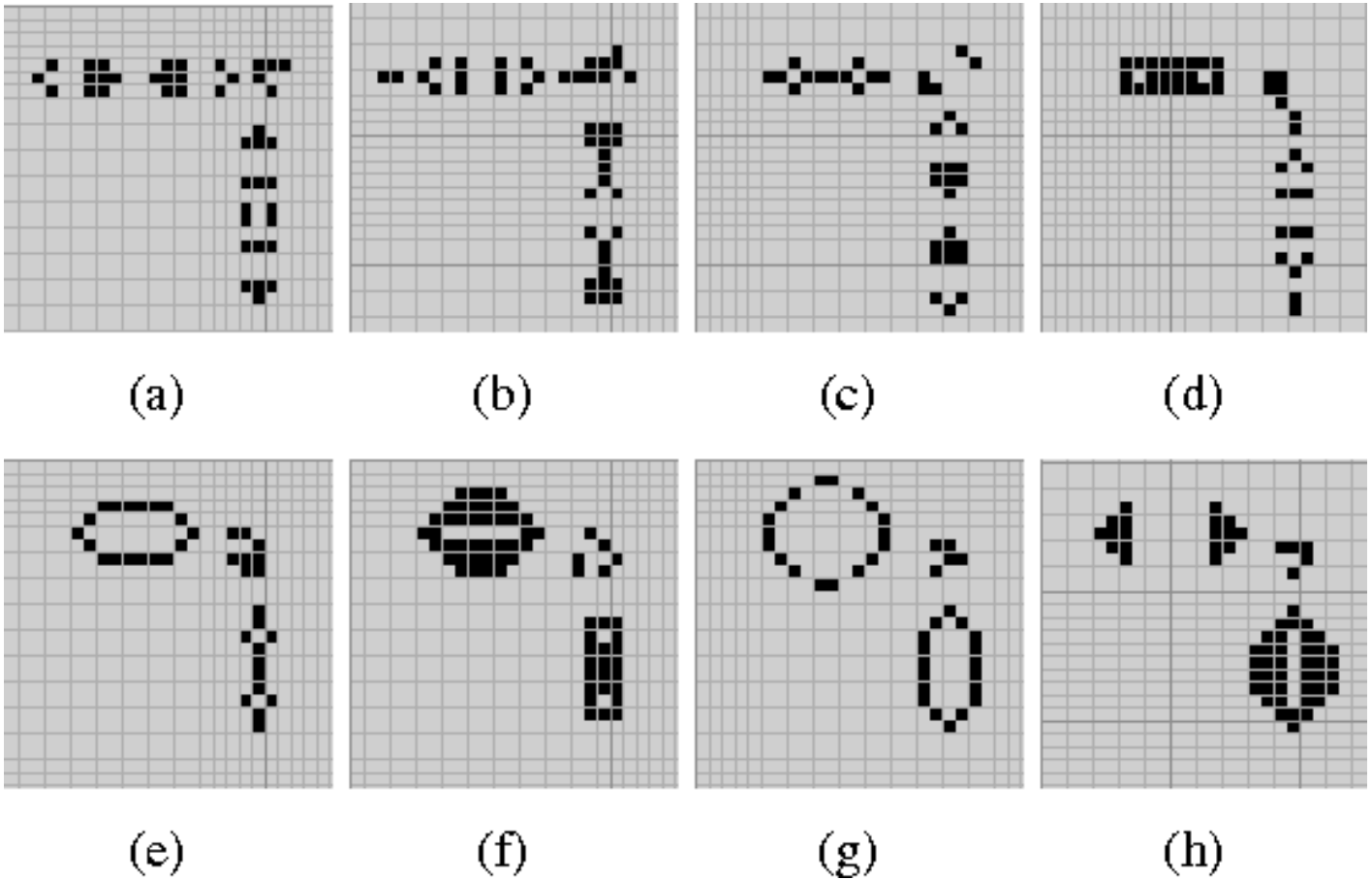
@miyokoshimura



Details: https://en.wikipedia.org/wiki/Turing_machine

Counter machines

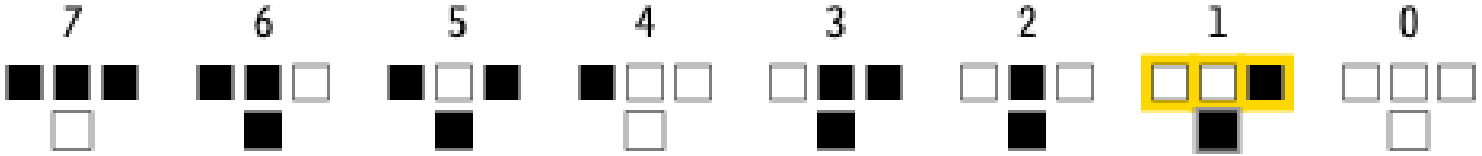
- Can be thought in one of two ways.
- Same structure as multistack machine.
- Each stack in the machine is replaced by a counter.
- Counter hold any nonnegative integer.
- The move of a machine depends on the
  1. current state
  2. current input symbol
  3. if one of the value of the counter is zero



Details: https://en.wikipedia.org/wiki/Conway%27s_Game_of_Life

current automaton contents

rule 110 (01101110)



the next generation of the automaton

Details: https://en.wikipedia.org/wiki/Rule_110

SUBLEQ - A One Instruction Set Computer (OISC)

29 May 2020 Lawrence Woodman

#Programming #SUBLEQ

SUBLEQ has to be one of the easiest architectures to implement in either software or hardware and this is the main reason for its design as a teaching aid. It has only one instruction, hence why it is called a One Instruction Set Computer (OISC), which isn't the best name considering that most processors have one instruction set. URISC is good, but perhaps One Instruction Computer (OIC) would be more accurate.

SUBLEQ (SUbtract and Branch if Less than or EQual

The SUBLEQ instruction stands for *SUbtract and Branch if Le*
EQual to zero. Because there is only one instruction, only
are specified, which consist of 3 memory addresses that are

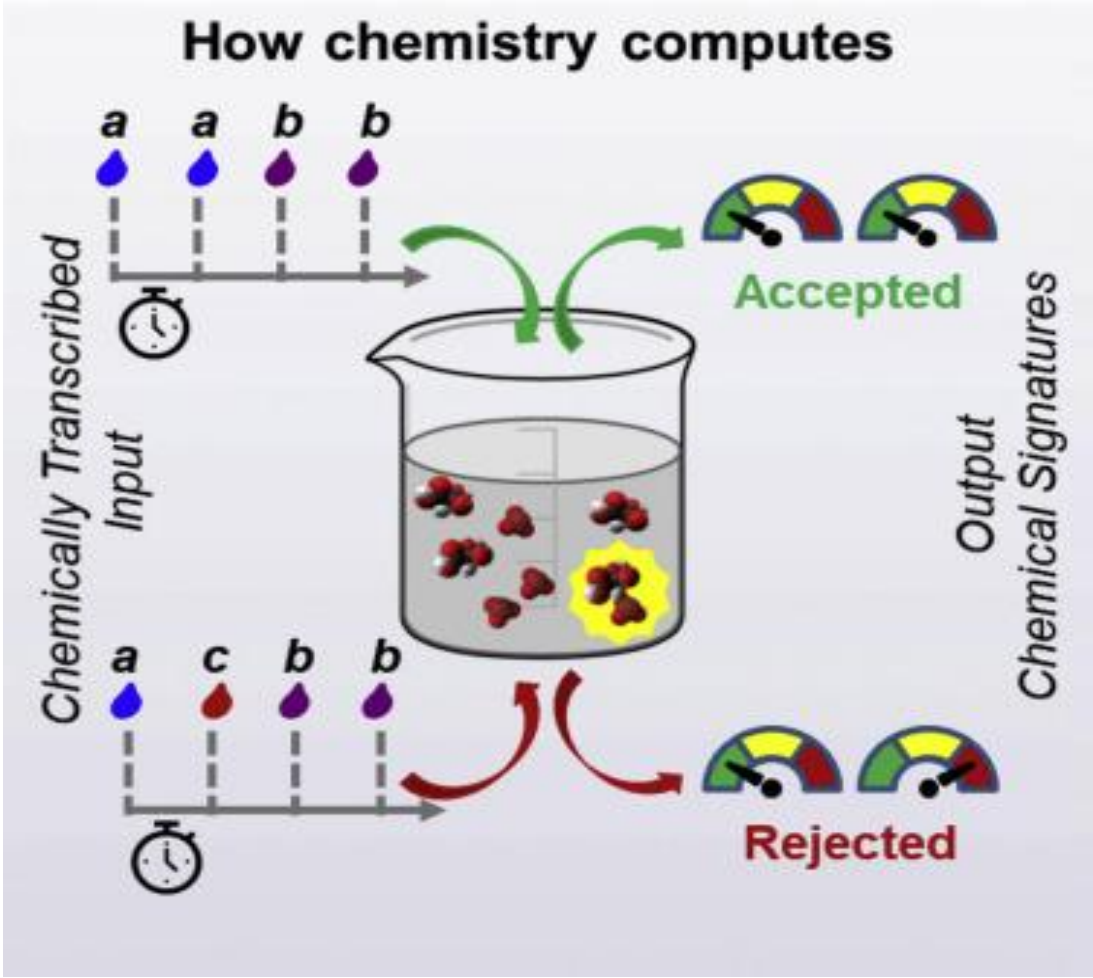
```
; Outputs "HELLO, WORLD!\n"
.equ        OUT  -1
.equ        HALT -1

loop:       sble  hello OUT         ; Ou
            sble  #-1 loop          ; In
            sble  #-1 checkEnd+1    ; In
checkEnd:   sble  z hello HALT      ; Ha
            sble  z z loop          ; Ju

hello:      .asciiz "HELLO, WORLD!\n"
z:          .word   0
```

Brainfuck Programming Language

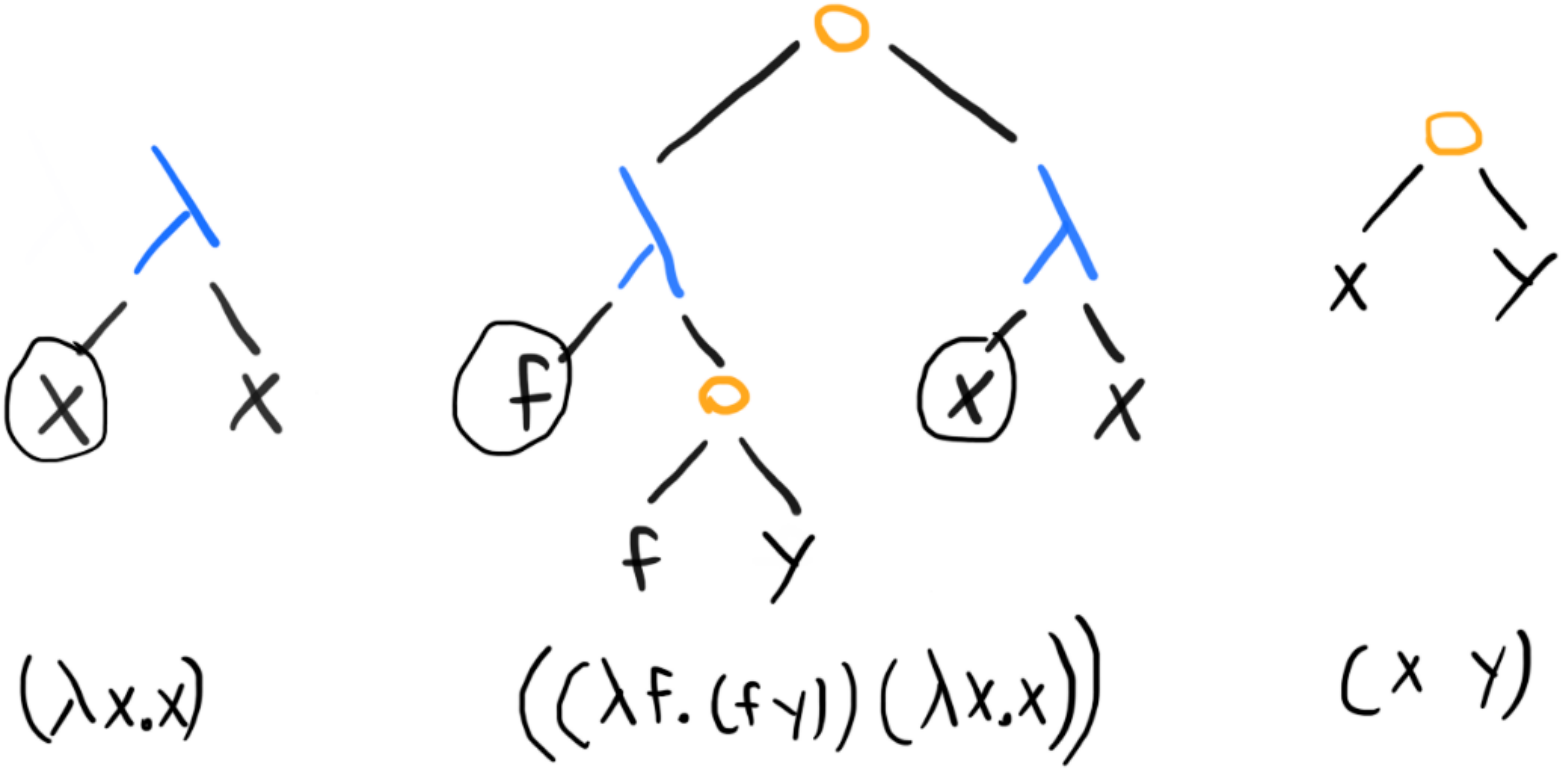
- created in 1993 by Urban Müller
- Only 8 instructions
  - Müller's Amiga compiler was 240 bytes in size
  - x86/Linux by Brian Raiter had 171 Bytes!

```
+++[>++++++[>++++++>++++++>++++>++
++>+<<<<<-]>++++>+++>+++>+<<<<<
-]>>.>.>+.>.>-----.
```

```
<                   Goto T1
[                   While T1 is nonzero
  >                 Goto T2
  [->+>+<<]         Copy T2 to T3 and T4
  >>                Goto to T4
  [-<<+>>]          Move T4 to T2
  <                 Goto to T3
  [-<<<+>>>]        Accumulate T3 onto T0
  <<                Goto to T1
  -                 Decrement T1
]
```


How chemistry computes
a a b b
Chemically Transcribed
Input
a c b b
Accepted
Output
Chemical Signatures
Rejected

λ-Calculus (A. Church, 1936)

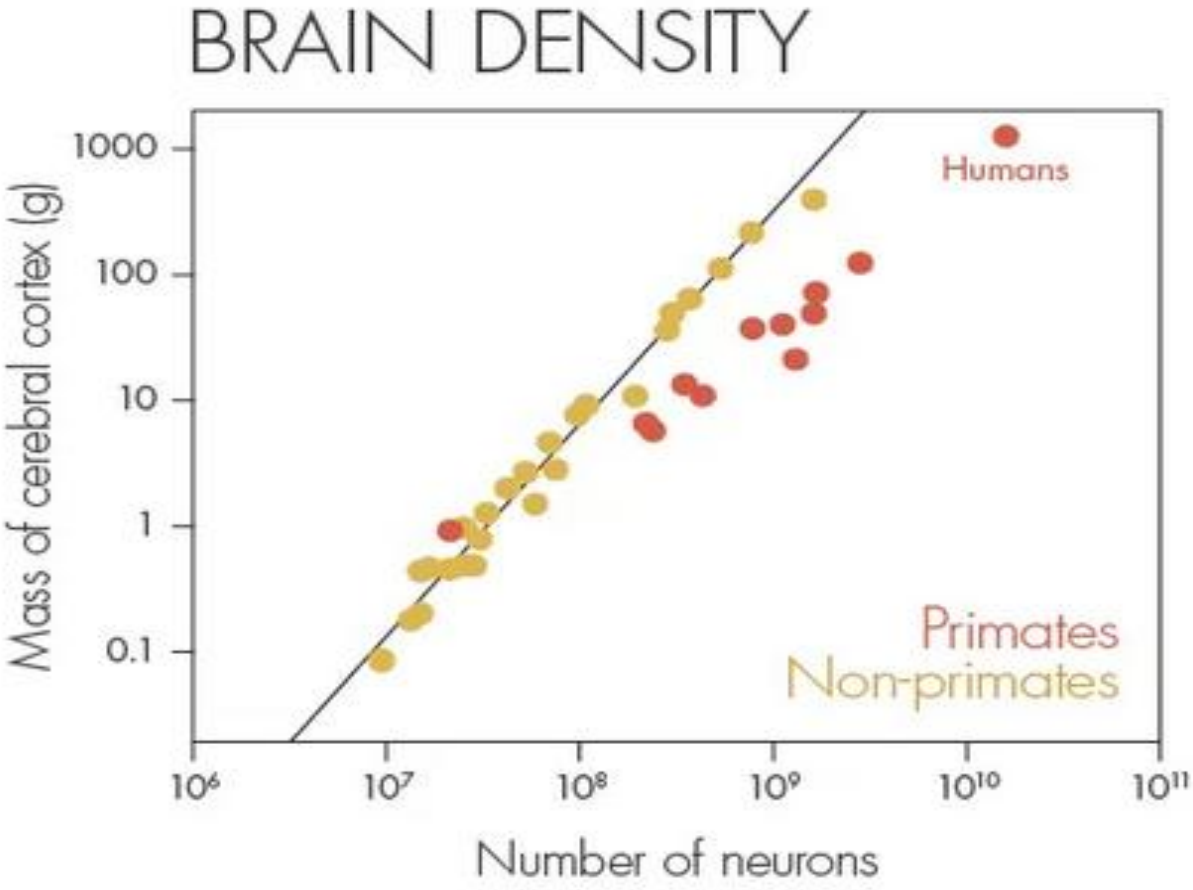


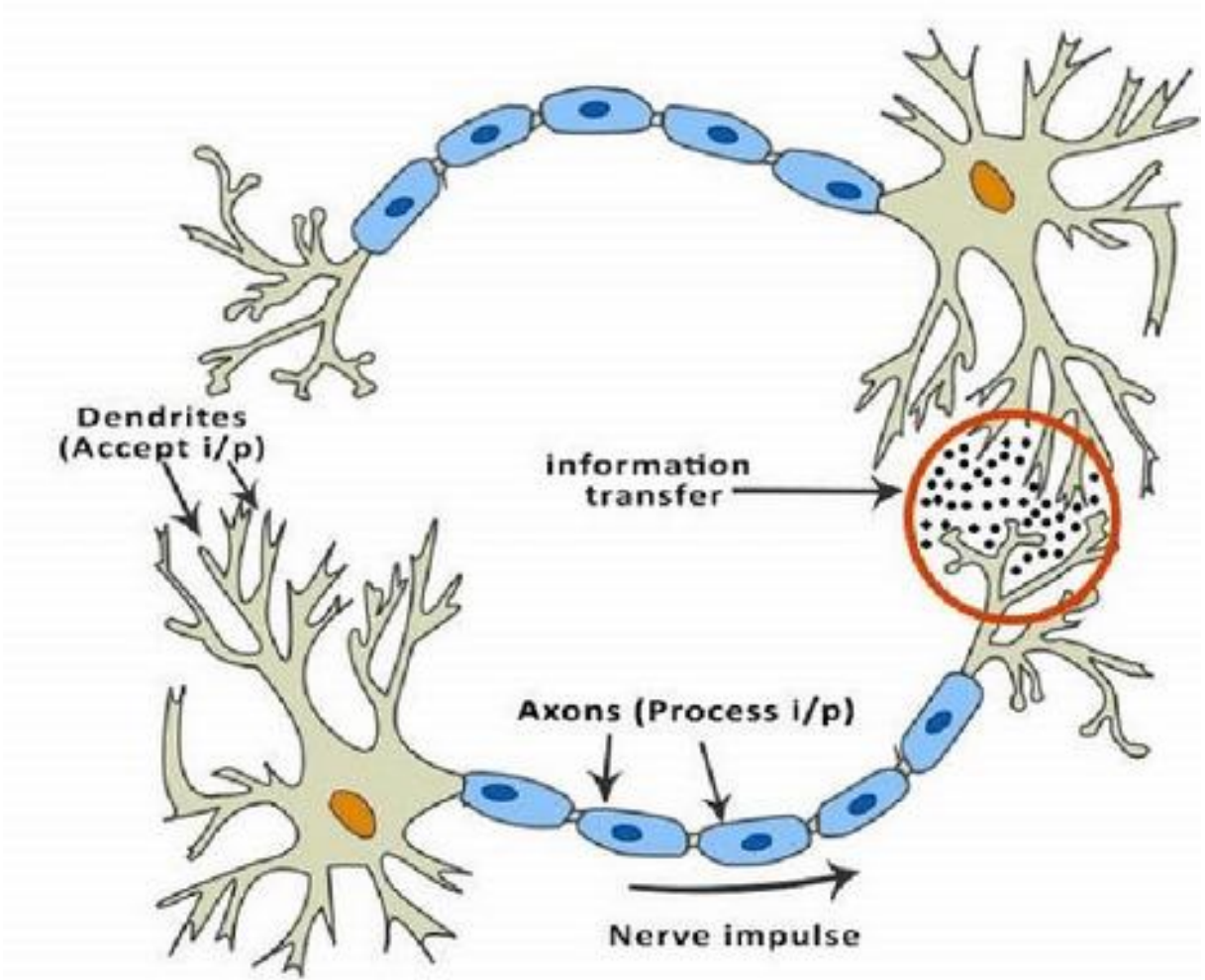
Details: https://en.wikipedia.org/wiki/Church%E2%80%93Turing_thesis

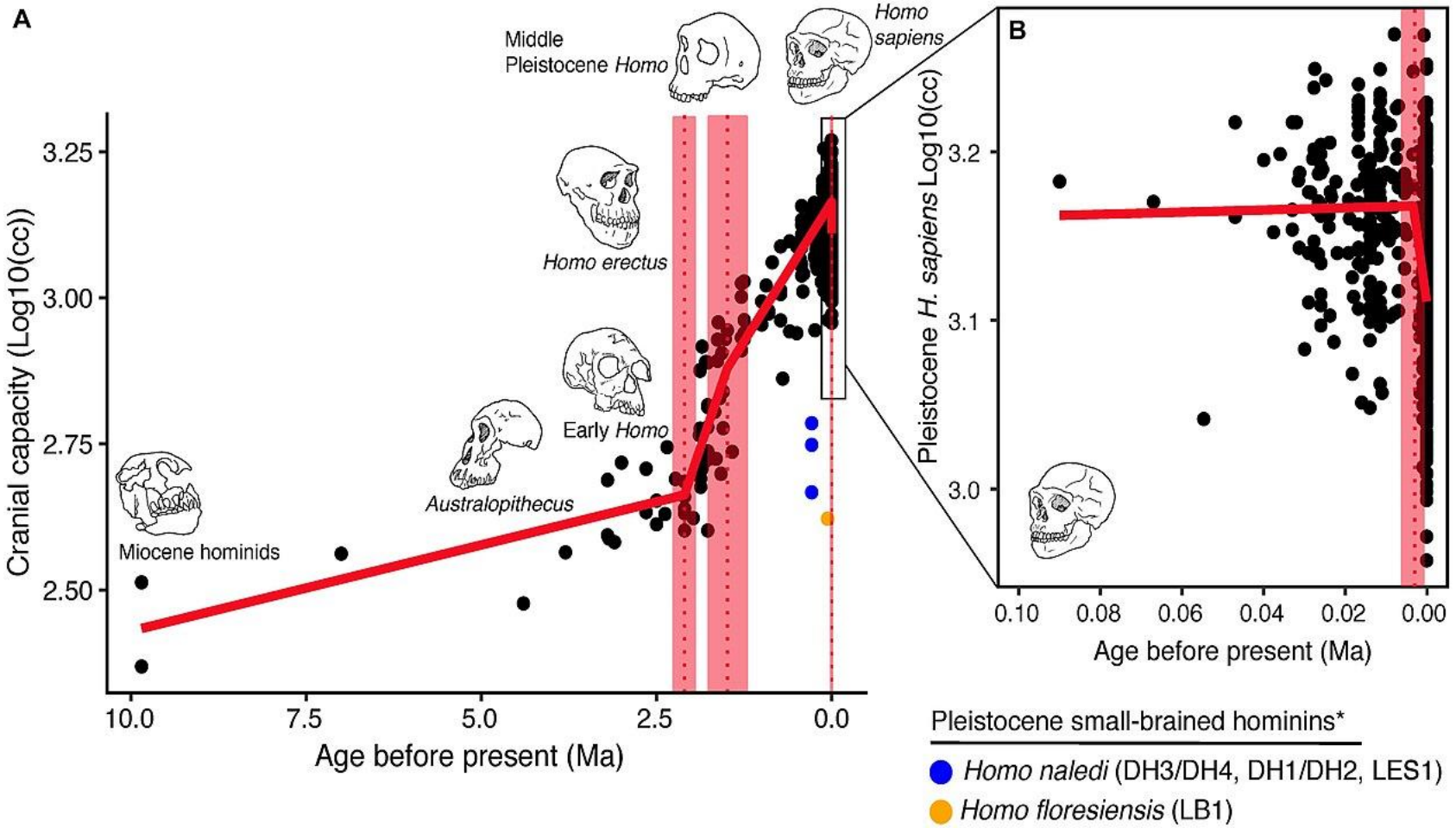
BRAIN SIZE AND NEURON COUNT

Cerebral cortex mass and neuron count for various mammals.

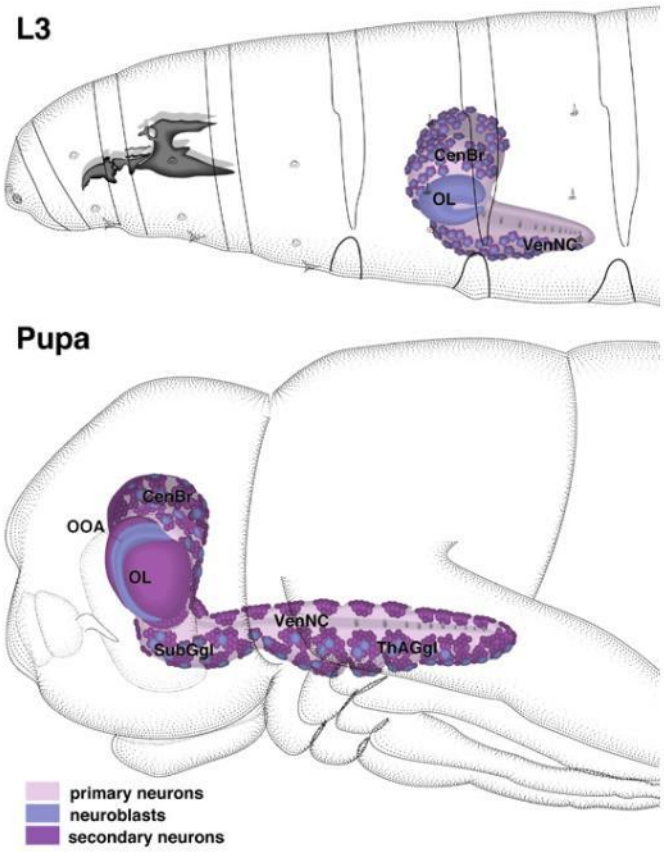
Capybara	Rhesus Macaque	Western Gorilla	Human	African Bush Elephant
non-primate	primate	primate	primate	non-primate
48.2 g	69.8 g	377 g	1232 g	2848 g
0.3 billion neurons	1.71 billion neurons	9.1 billion neurons	16.3 billion neurons	5.59 billion neurons

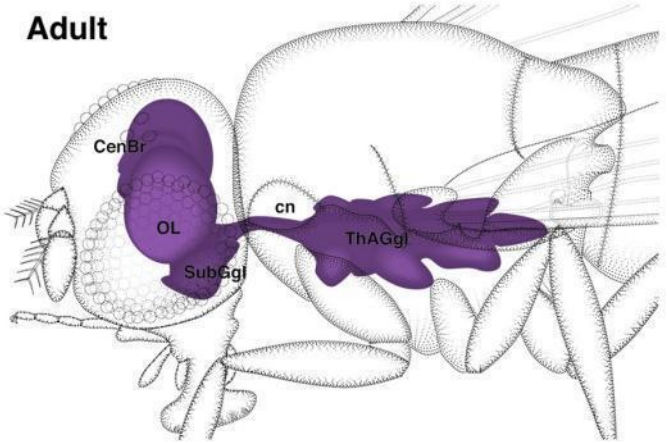

BRAIN DENSITY
Mass of cerebral cortex (g)
1000
100
10
1
0.1
Humans
Primates
Non-primates
10⁶
10⁷
10⁸
10⁹
10¹⁰
10¹¹
Number of neurons


Dendrites
(Accept i/p)
information
transfer
Axons (Process i/p)
Nerve impulse



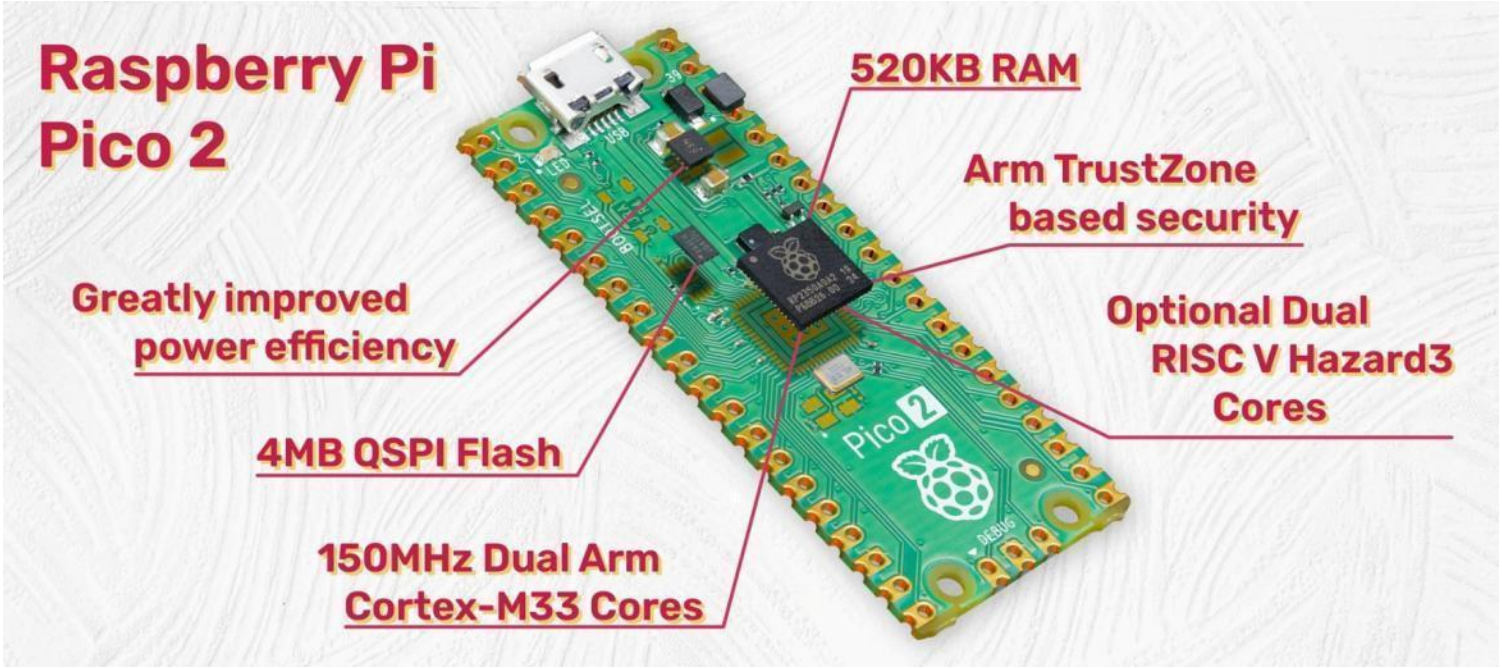
Details: https://en.wikipedia.org/wiki/Brain_size





- Earthworm: n=302 (s=7,500)
- Sea slug: n=18,000
- Fruit fly: n=150,000
- Ant: n=250,000
- Honey bee: n=960,000 (s=10^9)
- Cockroach: n=10^6
- Brown rat: n=$31x10^6$ (s=$3x10^6$)

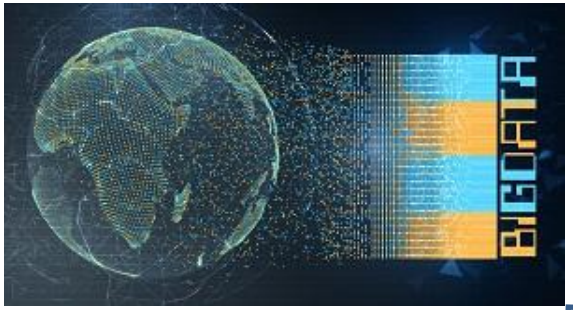
Details: https://en.wikipedia.org/wiki/List_of_animals_by_number_of_neurons



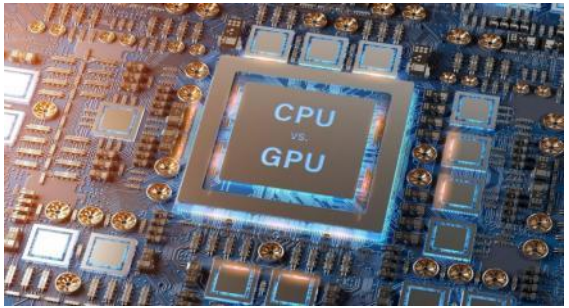
- 520KB RAM ≈ 133,120 “synapse” weights (32-bit FP variables)
- FP arithmetic (FxMadds) ≈ 300 per sample @ 44100 khz
- FP benchmark ≈ 1.5 MFLOPS @ 133 MHz (≈ 11 Hz “brain”)
- *RPi 5 (SBC): 4 cores / x16 memory / x37 speed*

Τι έχει αλλάξει τα τελευταία 10-15 χρόνια;

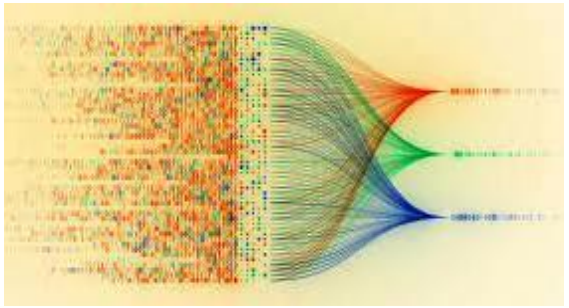
Big (Open) Data

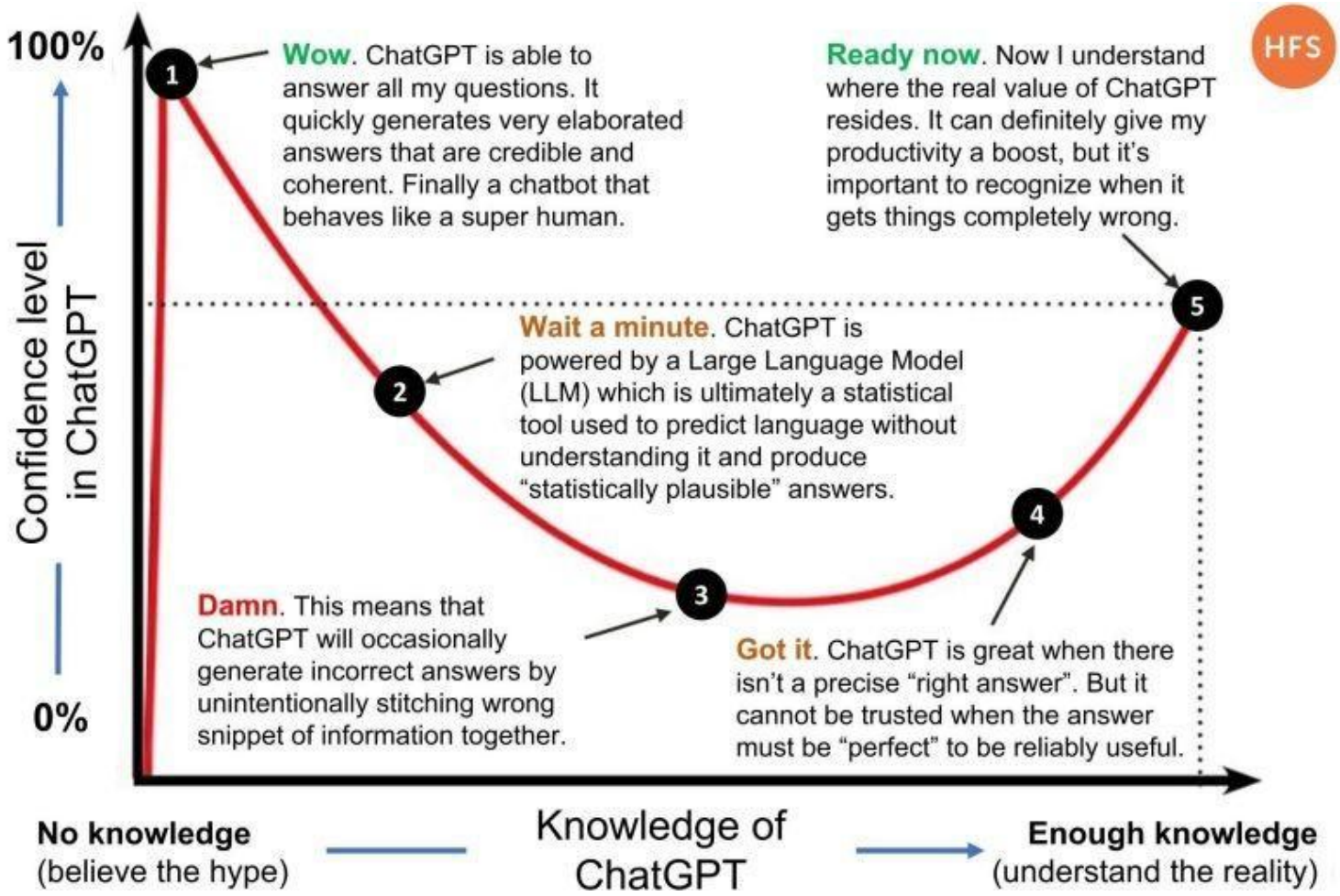


GPU accelerators



Deep Learning,
Transformers,
LLMs, ...





Source: A. AlQuraini, "ChatGPT as seen through the Dunning-Kruger Curve" (26/2/2023)

Modelling Swarm Drones:

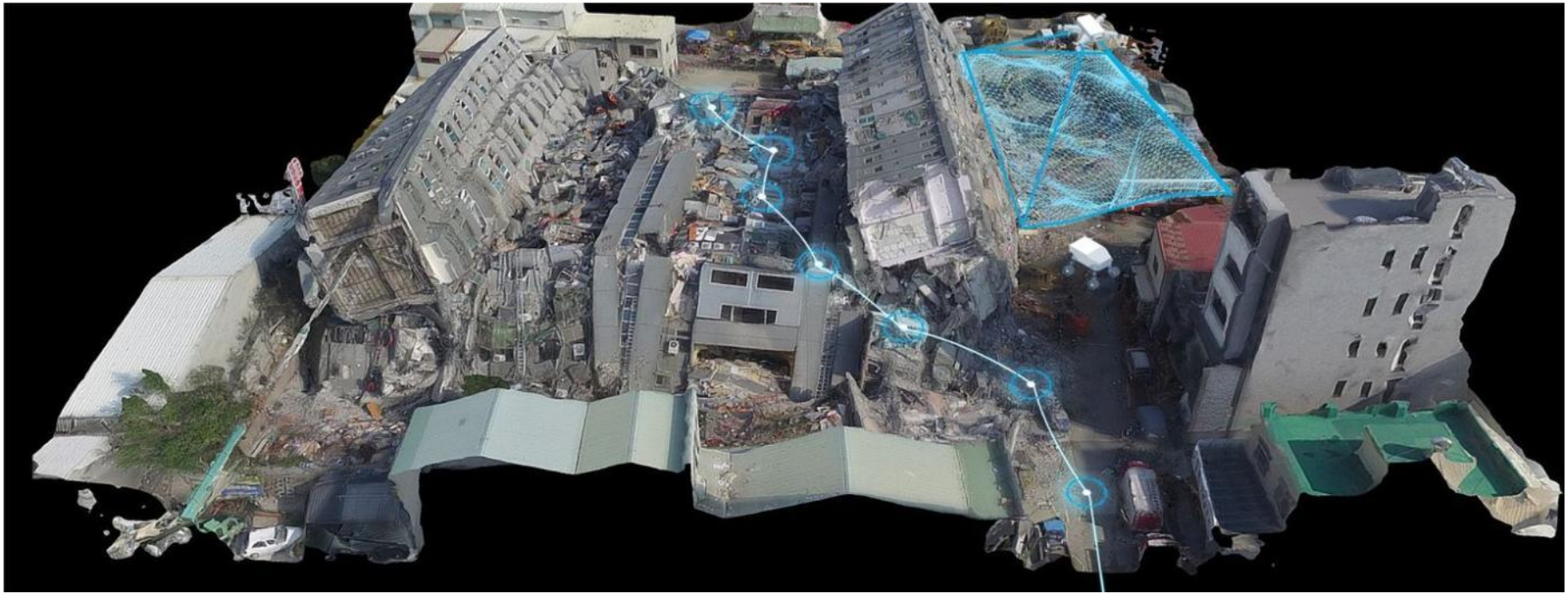
Creation of orthophoto and 3-D model of disaster area with 5 pre-programmed drones

Credits: CURSOR project (EU H2020)

Earthquake in Turkiye

Live 3-D optimal route planning:

Risk assessment and FR team navigation inside the hotzone



Credits: INTREPID project (EU H2020)

Future trends: Body part detection & assessment

IEEE Sensors Council IEEE SENSORS JOURNAL, VOL. 20, NO. 7, APRIL 1, 2020 3697

Data-Driven Skin Detection in Cluttered Search and Rescue Environments

Yogeshwar Singh Dadwhal, *Student Member, IEEE*, Satish Kumar, *Member, IEEE*, and H. K. Sardana, *Member, IEEE*

Abstract—Locating human victims in cluttered urban search and rescue (USAR) environments is still a challenge. In this paper, we present an approach to generate *skin objectness* windows to assist human rescuers. We introduce the term *skin objectness* to denote the task of extracting windows in the scene with a high probability of skin presence for locating victims. Unlike naïve skin segmentation approaches, the presented algorithm accounts for both color and spatial information to extract regions of interest and at the same time, rejects the background clutter. We use temporal information of the video sequence to make the skin objectness windows more reliable. To selectively boost skin regions, the RGB skin pixels are transformed to Gabor space to generate a transformation matrix. The matrix is used to generate skin Further, the Bayesian inference and temporal cues from previ it has real-time applications in image retrieval, action clas demonstrates quantitative and qualitative results on a disast proposed method in cluttered environments.

Index Terms— Distinctiveness, Gabor filters, color image a

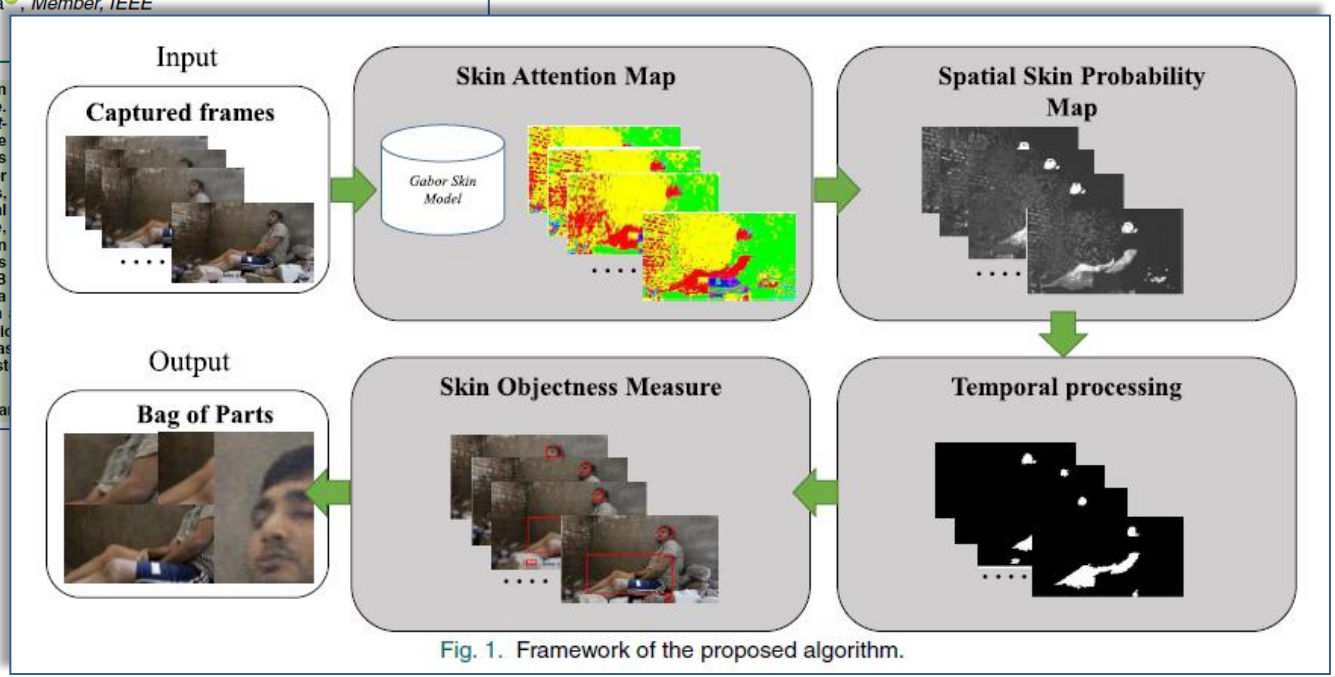
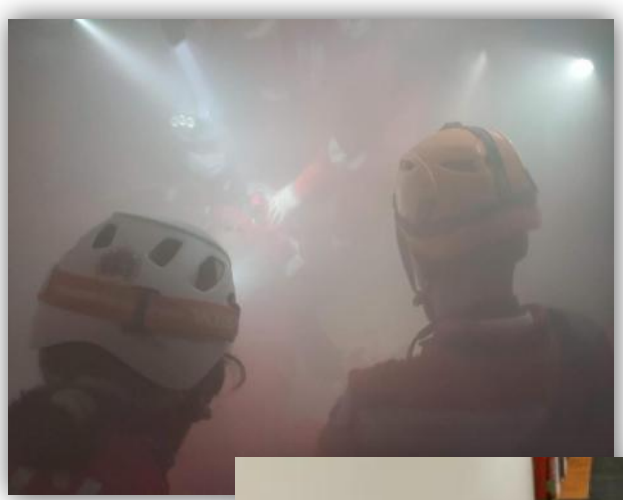
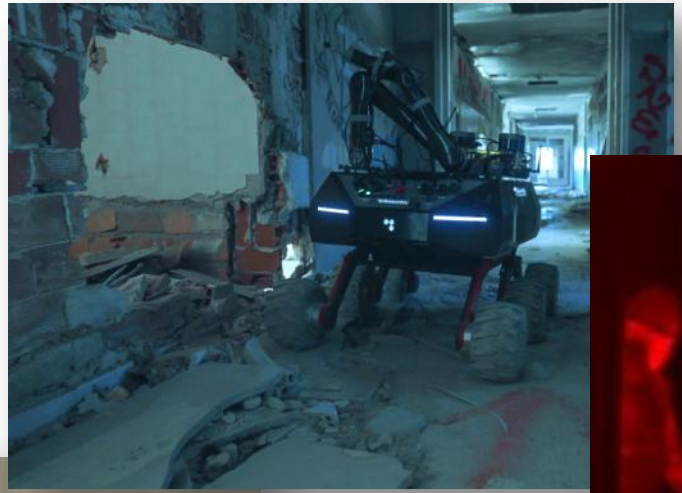


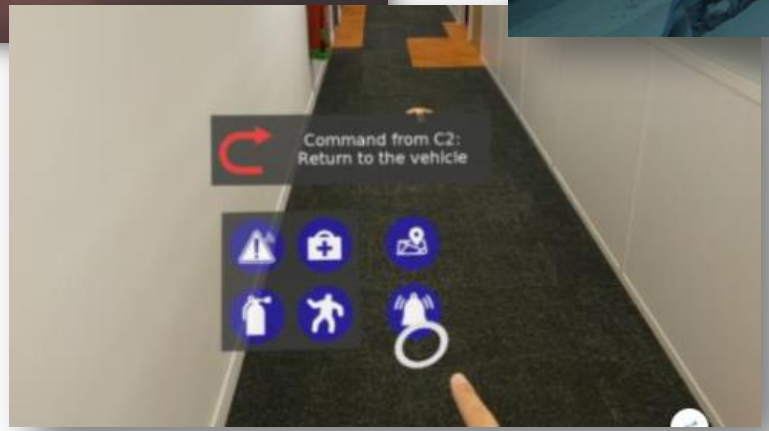
Fig. 1. Framework of the proposed algorithm.

FR safety and remote sensing:

Mapping and navigation inside the hotzone with sensors, AR and UxVs







Credits: INTREPID, INGENIOUS projects (EU H2020), HRTA

Τροφή για σκέψη...

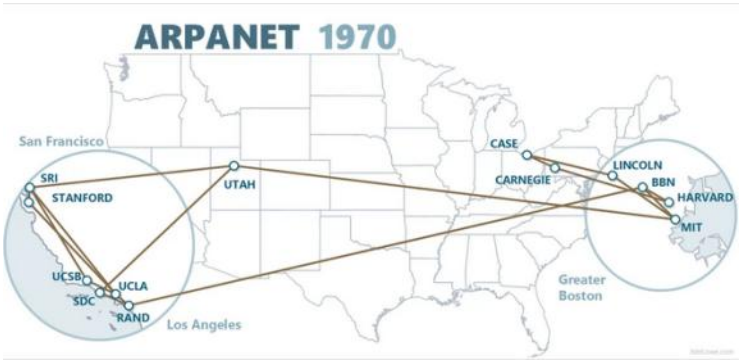
- A.I. = «πολλαπλασιαστής»
- Generative A.I.
- Large Language Models (LLM)
- Transformers
- Big (Open) Data
- Cloud → Edge → IoT
- EU A.I. Act, USA Exec. Order

- Η ελληνική πραγματικότητα
- Brain drain
- «Έλλειψη ταλέντων»...
- «Πληροφορικάριοι»...
- Ψηφιακός αναλφαβητισμός
- «Φορολόγηση των ρομπότ»
- «Dark Internet forest»

Είμαστε έτοιμοι ? → Φυσικά **όχι** (όπως πάντα άλλωστε)

Τι χρειάζεται για να πετύχει;

1. Αφοσίωση και όρεξη + Επιστημονική επάρκεια
2. Απαραίτητοι πόροι, κυρίως δημόσιοι στο ξεκίνημα
3. Κυρίως **<u>όραμα</u>** για το που πάμε και με τι στόχο



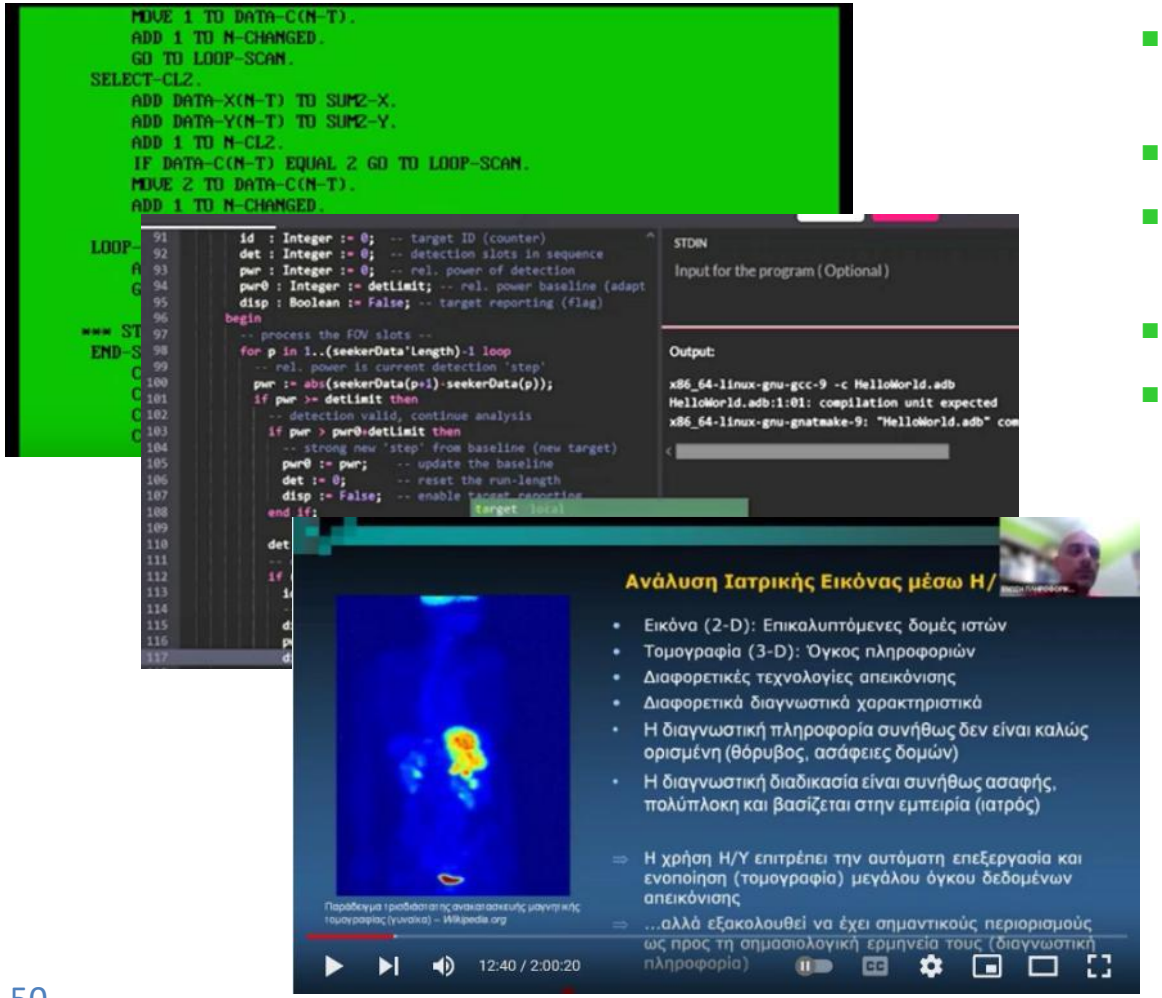
23 χρόνια

Source: “13 minutes to the Moon” (podcast) – https://www.bbc.co.uk/programmes/w13xttx2

Σύνοψη

- Περιεχόμενα:
  - Μέρος Ι: Τεχνητή Νοημοσύνη – Βασικές Έννοιες
  - Μέρος ΙΙ: Μελλοντικές Προοπτικές

- Σχετικό υλικό:
  - «Turing machines explained visually» – https://www.youtube.com/watch?v=-ZS_zFg4w5k
  - «Game of life: computer with display» – https://www.youtube.com/watch?v=WfuhbI8HE7s
  - Computer History Museum (CHM) – https://www.youtube.com/@ComputerHistory
  - «Artificial Intelligence | 60 Minutes Full Episodes» – https://www.youtube.com/watch?v=aZ5EsdnpLMI
  - «Queens puzzle solver in LISP», @ApneaCoding – https://youtu.be/_1CRCyklUto
  - «BAM neural network in Arduino», @ApneaCoding – https://youtu.be/RkM-rpSVD4I



- Hamming (7,4) error correction codes in R
- Kmeans clustering in COBOL
- Bi-directional Associative Memory (BAM) in Arduino/C
- Linear Regression in SQL, Matlab
- ...

YouTube:

@ApneaCoding

https://www.youtube.com/@apneacoding

https://www.facebook.com/apneacoding

Github:

@xgeorgio

https://github.com/xgeorgio

http://apneacoding.blogspot.com

Ένας ψηφιακός κόσμος γεμάτος γνώση για όλους

Σύμφωνα με το Καταστατικό της Ένωσης Πληροφορικών Ελλάδας, ένας από τους βασικούς σκοπούς της λειτουργίας της είναι η προώθηση της γνώσης και χρήσης των πληροφορικών αγαθών από το κοινωνικό σύνολο και η εξάλειψη της τεχνοφοβίας και του "αναλφαβητισμού" στην Πληροφορική.

https://courses.epe.org.gr

Σχετικά με τα ανοικτά μαθήματα της Ένωσης Πληροφορικών Ελλάδας:

- ✓ Τα μαθήματα πραγματοποιούνται εξ ολοκλήρου διαδικτυακά, ζωντανά μέσω της πλατφόρμας Zoom.
- ✓ Η συμμετοχή σε όλα τα μαθήματα είναι ελεύθερη για οποιονδήποτε από οπουδήποτε στην Ελλάδα ή στο εξωτερικό.
- ✓ Δεν υπάρχει οικονομικό κόστος ή άλλες προϋποθέσεις συμμετοχής.
- ✓ Οι Εισηγητές είναι μέλη της Ένωσης Πληροφορικών Ελλάδας και πραγματοποιούν τα μαθήματα εθελοντικά.
- ✓ Τα μαθήματα μαγνητοσκοπούνται και παραμένουν διαθέσιμα για σύγχρονη παρακολούθηση στο Αρχείο Μαθημάτων.
- ✓ Η εκπαίδευση που παρέχεται μέσω των ανοικτών διαδικτυακών μαθημάτων είναι άτυπη και δεν παρέχονται βεβαιώσεις παρακολούθησης στους συμμετέχοντες.

Ερωτήσεις

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