Ένωση Πληροφορικών Ελλάδας

Η Επιστημονική Μεθοδολογία στις Θετικές Επιστήμες

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

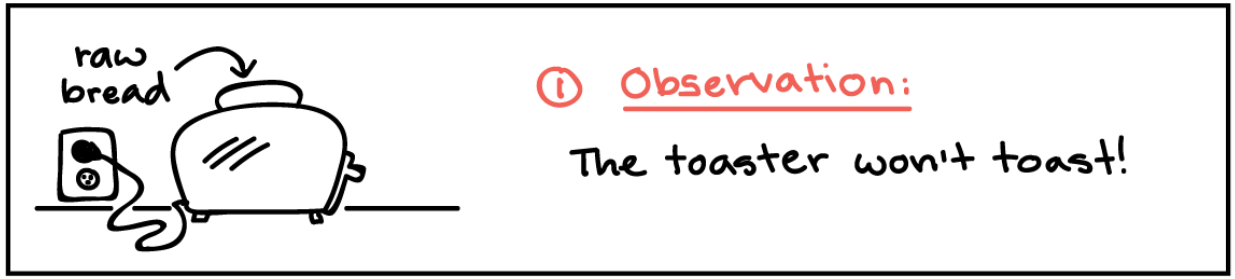
- R&D: Associate post-doc researcher and lecturer with the University Athens (NKUA) and University of Piraeus (UniPi)
- Consultant in Medical Imaging, Machine Learning, Data Analytics, Signal Processing, Process Optimization, Dynamic Systems, Complexity & Emergent A.I., Game Theory
- HRTA member since 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, 170+ scientific papers/articles (and 5 marathons)

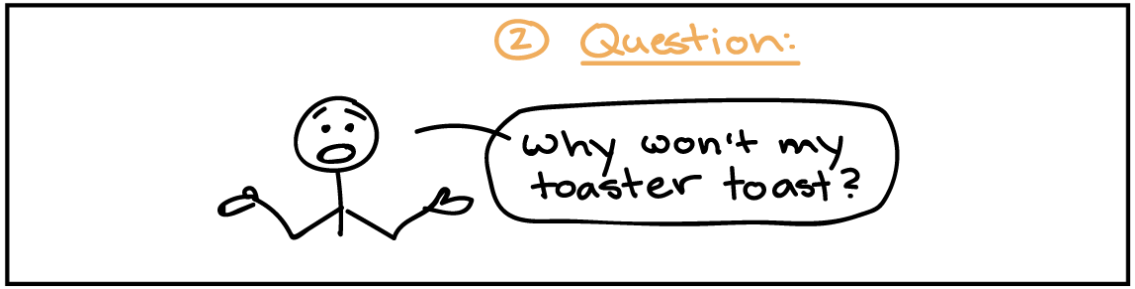
Επισκόπηση

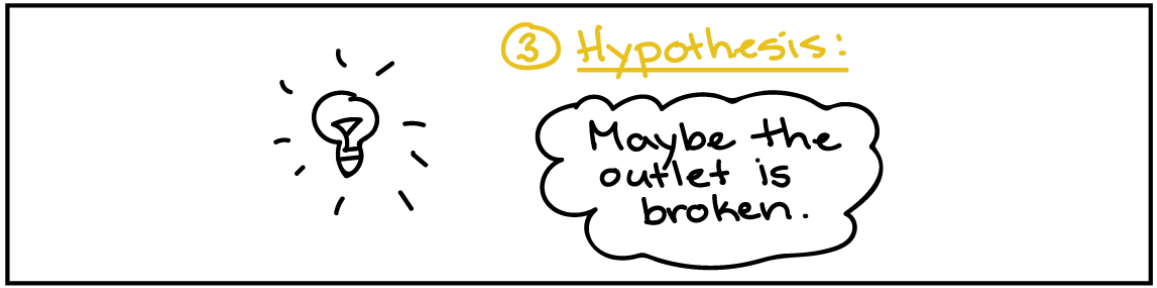
- Περιεχόμενα:
  - Τι είναι η «Επιστημονική Μεθοδολογία» στις Θετικές Επιστήμες.
  - Γιατί η παρατήρηση και η πειραματική αξιολόγηση είναι σημαντικοί παράγοντες.
  - Ποια είναι τα προβλήματα και οι κίνδυνοι στη σχεδίαση και στην εφαρμογή.
  - Επεξήγηση με ένα πραγματικό πρόβλημα-παράδειγμα:
    - *«Πρόβλεψη χρόνου άφιξης λεωφορείων στις προγραμματισμένες στάσεις»*
- Αναφορές:
  - «Εισαγωγή στη Μηχανική Μάθηση και στην Αναλυτική Δεδομένων», Χ. Γεωργίου, Α’ κύκλος ανοικτών μαθημάτων ΕΠΕ – https://youtu.be/mlU4SvyfRqA
  - «Εφαρμογές της Τεχνητής Νοημοσύνης στον πραγματικό κόσμο», Χ. Γεωργίου, Α’ κύκλος ανοικτών μαθημάτων ΕΠΕ – https://youtu.be/d2HnlWyQse4
  - «Particle Swarm Optimization and RBF Neural Networks for public transport arrival time prediction using GTFS data», E. Chondrodima, H. Georgiou, N. Pelekis, Y. Theodoridis. *International Journal of Information Management Data Insights (IJIMDI), Vol. 2, Issue 2, Nov. 2022, 100086* (doi: 10.1016/j.jjimei.2022.100086)

Μέρος Ι: Βασικές έννοιες

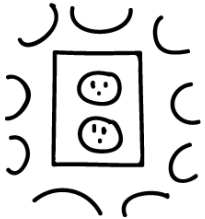
1. Τι είναι η Επιστημονική Μεθοδολογία;
2. Γιατί είναι σημαντική;
3. Ποιος τη σχεδιάζει-εφαρμόζει-αξιολογεί;
4. Τι προβλήματα υπάρχουν;





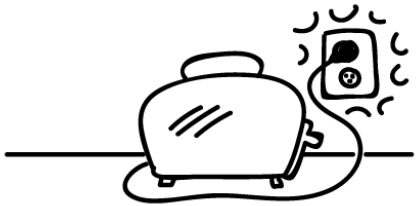


Source: https://www.khanacademy.org/science/biology/intro-to-biology/science-of-biology/a/the-science-of-biology



④ Prediction:

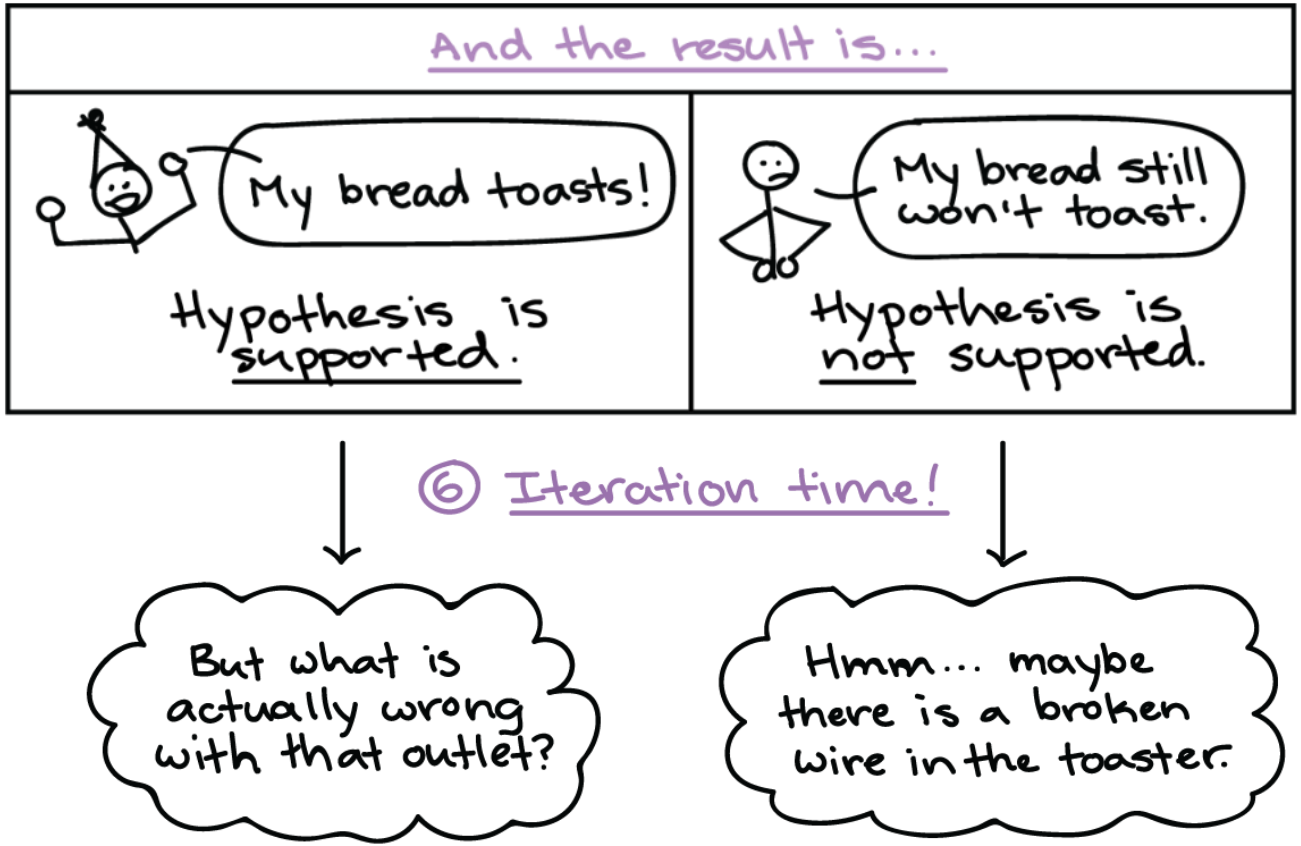
If I plug the toaster into a different outlet, then it will toast the bread.



⑤ Test of prediction:

Plug the toaster into a different outlet & try again.

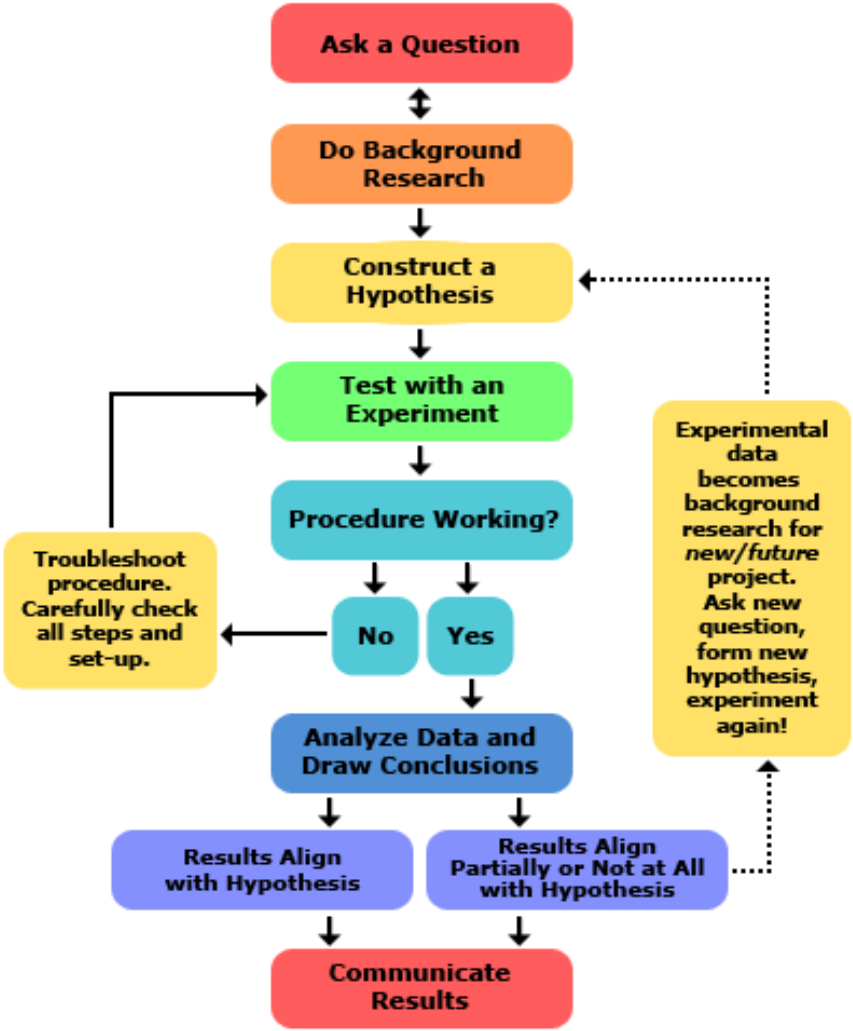
Source: https://www.khanacademy.org/science/biology/intro-to-biology/science-of-biology/a/the-science-of-biology



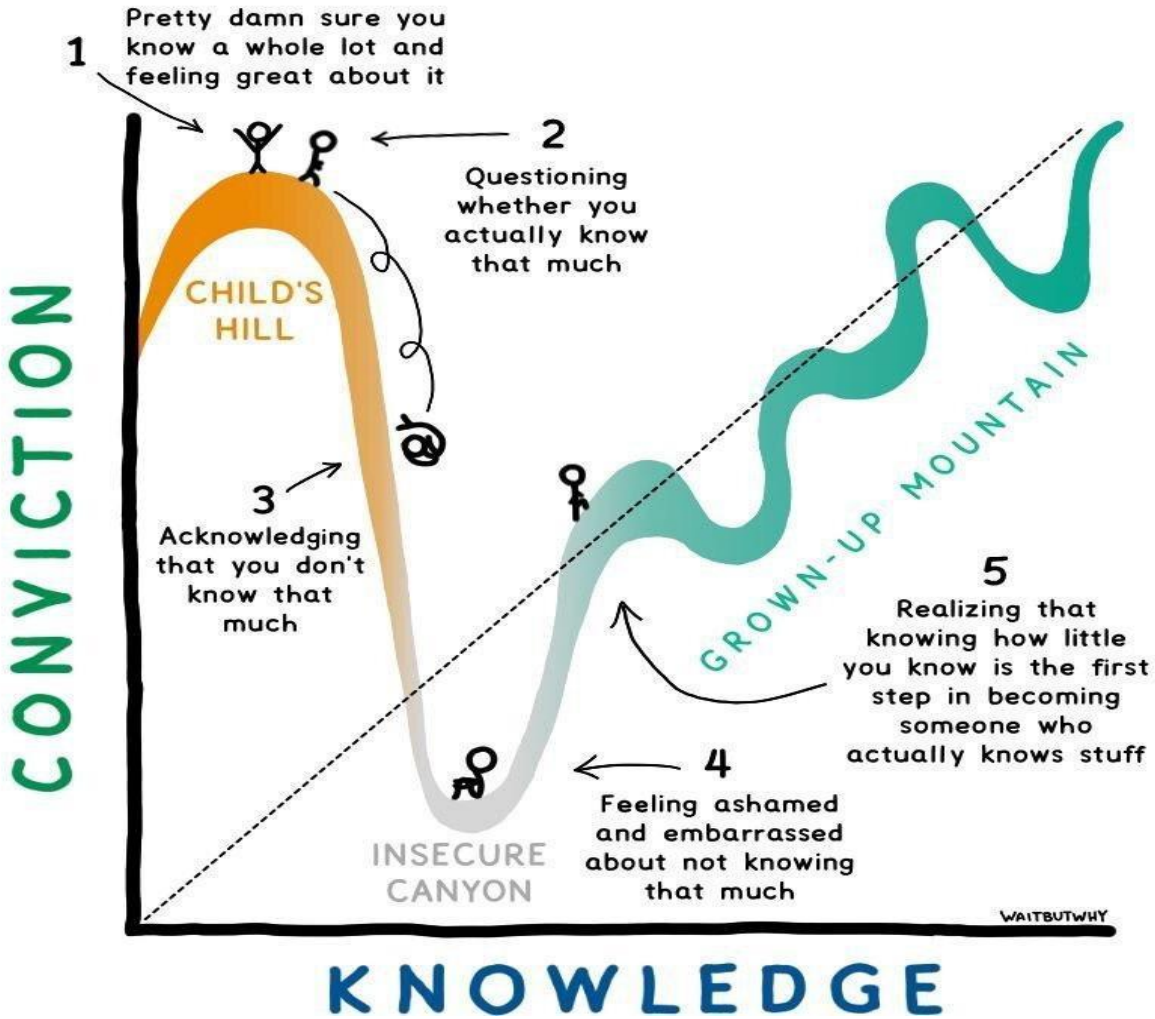
Source: https://www.khanacademy.org/science/biology/intro-to-biology/science-of-biology/a/the-science-of-biology

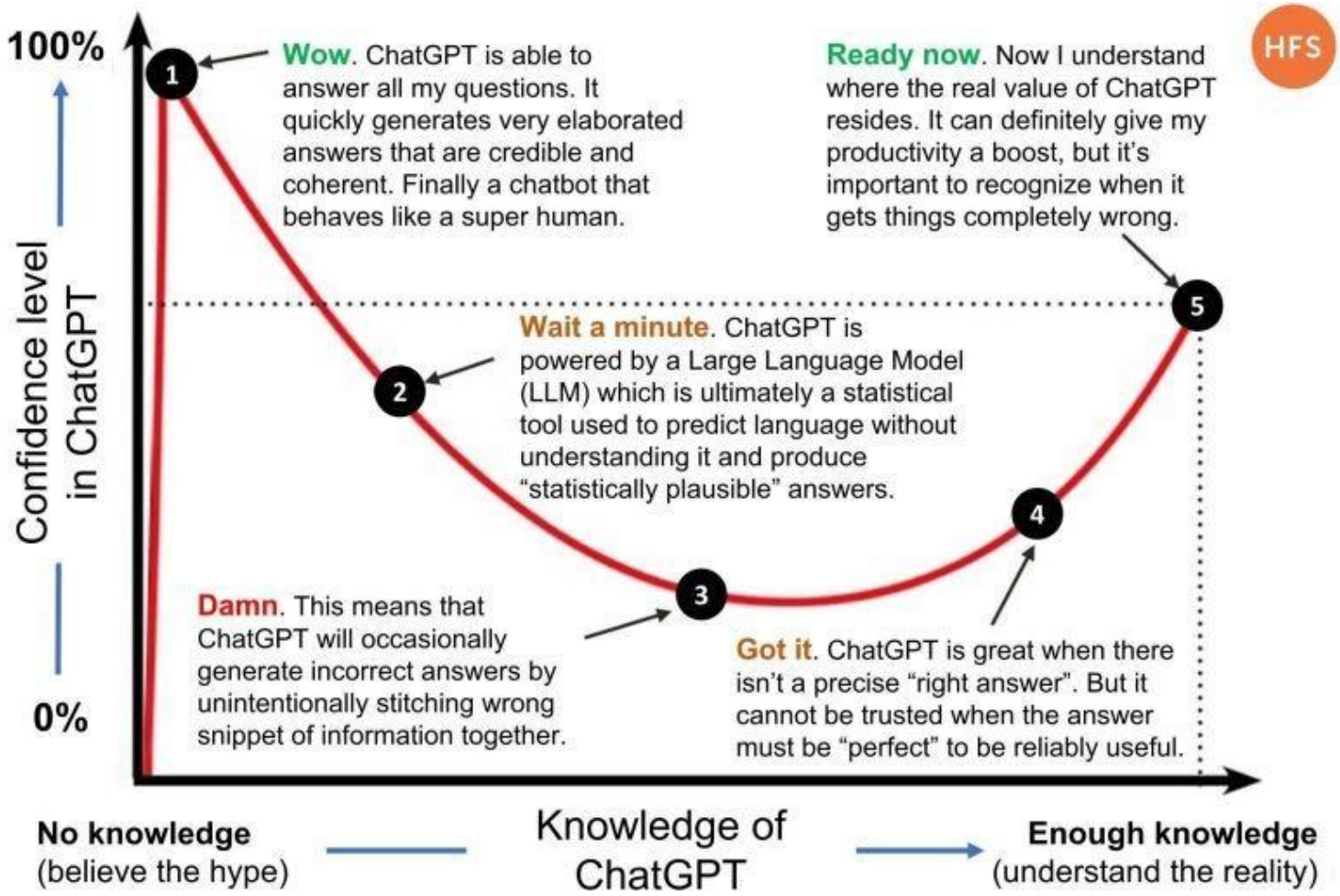
Summary:

1. Observation
2. Question
3. Hypothesis
4. Prediction (Model)
5. Verification (Test)
6. Iteration (Extend)



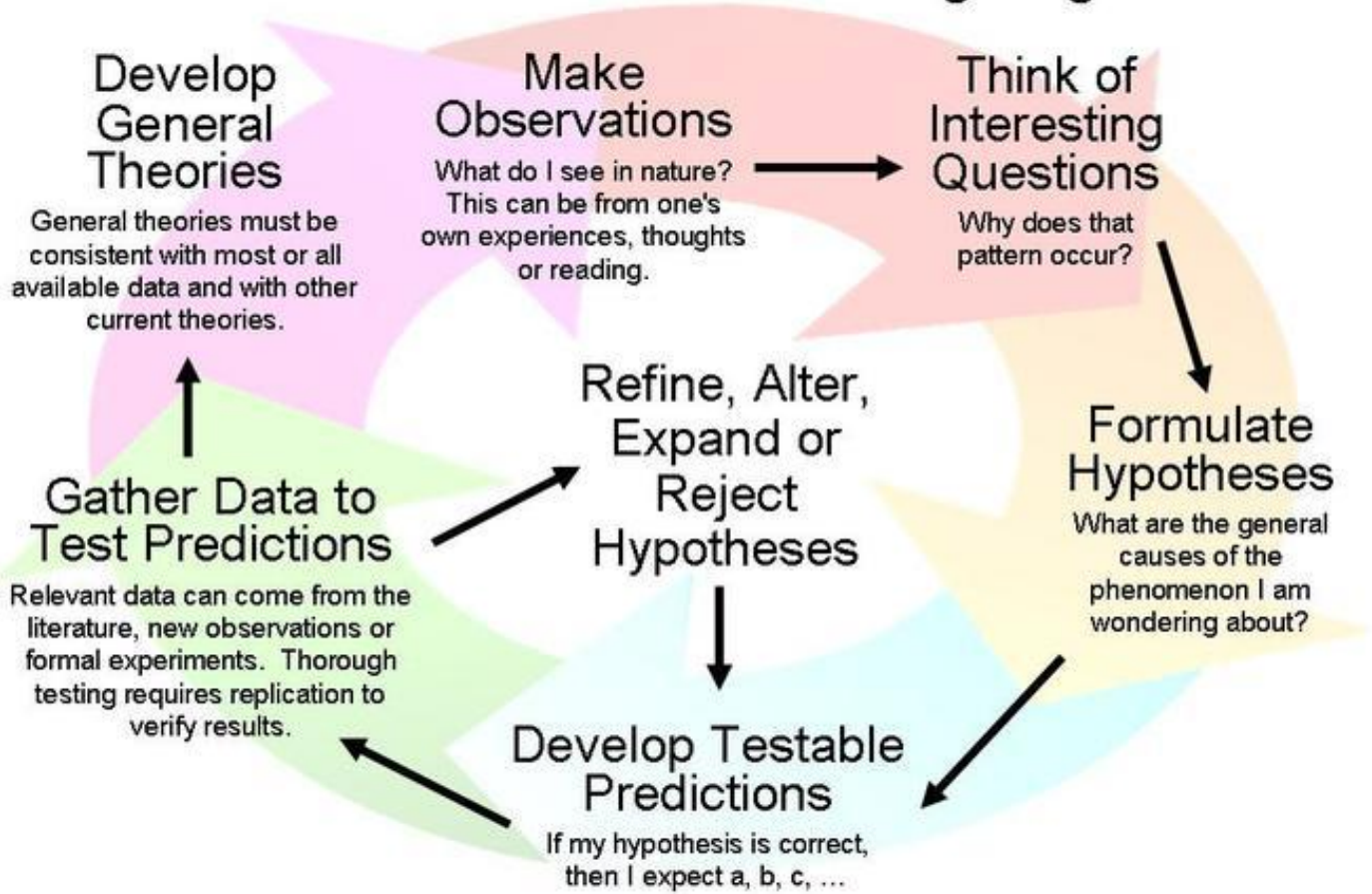
The Dunning-Kruger curve for scientific knowledge


1
Pretty damn sure you know a whole lot and feeling great about it
2
Questioning whether you actually know that much
CHILD'S HILL
3
Acknowledging that you don't know that much
INSECURE CANYON
4
Feeling ashamed and embarrassed about not knowing that much
GROWN-UP MOUNTAIN
5
Realizing that knowing how little you know is the first step in becoming someone who actually knows stuff
CONVICTION
KNOWLEDGE
WAITBUTWHY



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

The Scientific Method as an Ongoing Process



Ποσά πρόσωπα βλέπεις;

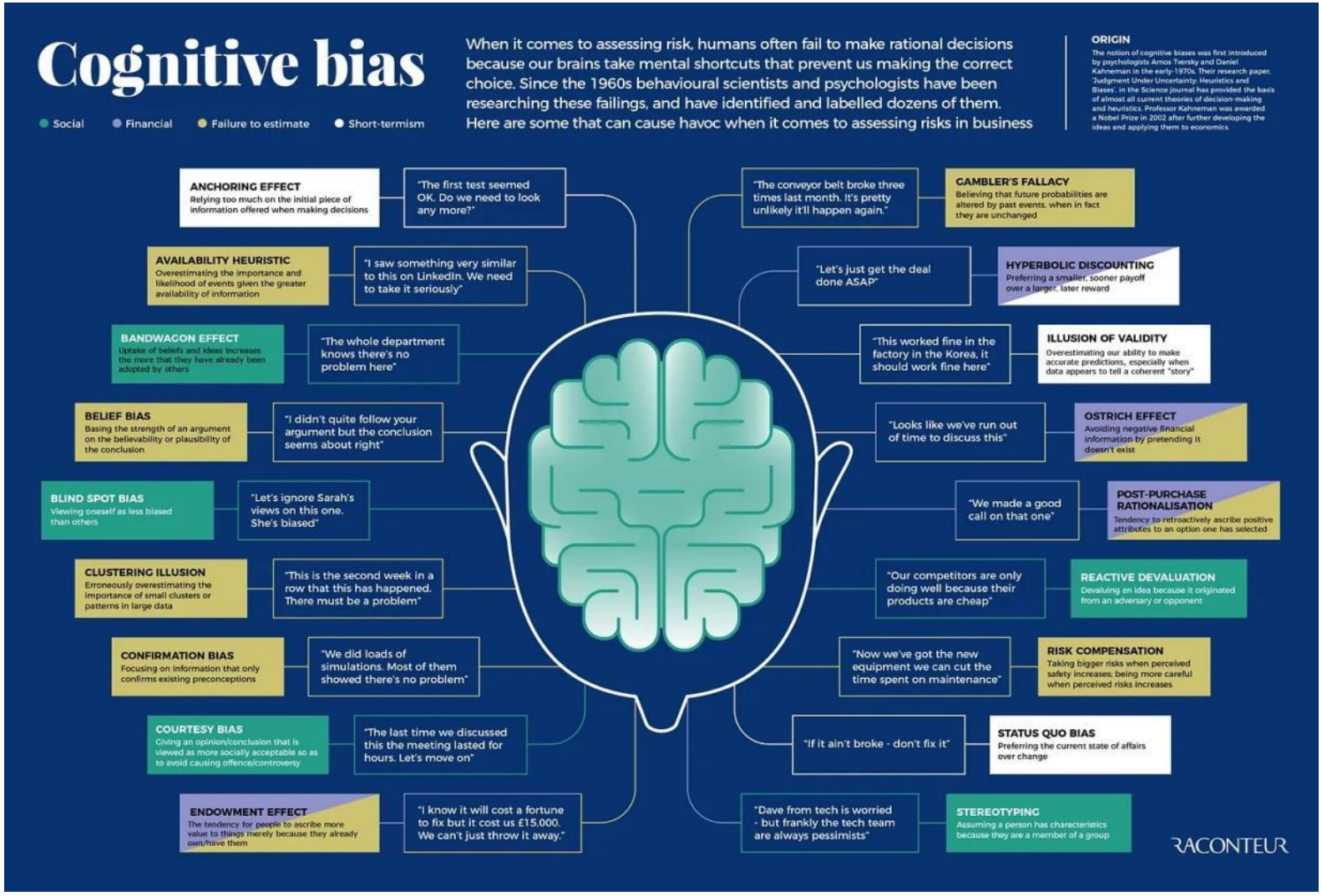
ΠΑΙΧΝΙΔΙ	ΠΙΘΑΝΟΤΗΤΑ ΝΙΚΗΣ, ΚΑΝΟΝΕΣ, ΝΟΜΙΜΟΤΗΤΑ
Παππάς	Κερδίζει ένα στα 3 χαρτιά, Παράνομο παιχνίδι Πιθανότητα νίκης 0,3333333
Μπαρμπούτι	Ρίχνεις 2 ζάρια. Κερδίζεις αν φέρεις (3,3),(5,5),(6,6),(6,5),(5,6).Πληθος ενδείξεων $6^2=36$ Παράνομο παιχνίδι .Πιθανότητα νίκης 0,14
Ρουλέτα	Ποντάρεις ένα αριθμό σε ρουλέτα με ένα 0. Νόμιμο παιχνίδι. Πιθανότητα νίκης 0,027
Λαϊκό λαχείο	Αγοράζεις ένα λαχείο σε έκδοση 800000 λαχνών. Νόμιμο παιχνίδι. Πιθανότητα νίκης 0,00000125
ΠΡΟ-ΠΟ	Όλες οι στήλες είναι $3^{13}=1594323$. Νόμιμο παιχνίδι. Πιθανότητα νίκης για 10 στήλες :0,00000627225
ΛΟΤΤΟ	Όλες οι εξάδες είναι $\binom{49}{16}=13983816$. Νόμιμο παιχνίδι. Πιθανότητα νίκης για 10 στήλες : 0.000000071511238
ΠΡΟΤΟ	Παίζεις 10 νούμερα .Όλες οι στήλες είναι 10^7. Νόμιμο παιχνίδι. Πιθανότητα νίκης:0,000001
ΤΖΟΚΕΡ	Όλες οι εξάδες είναι $\binom{45}{5}\cdot\binom{20}{1}=24435180$ Νόμιμο παιχνίδι. Πιθανότητα νίκης για 20 εξάδες :0,0000008
ΕΘΝΙΚΟ ΛΑΧΕΙΟ	Αγοράζεις ένα λαχείο σε έκδοση 20000000 λαχνών. Νόμιμο παιχνίδι. Πιθανότητα νίκης :0,0000005
ΞΥΣΤΟ	Αγοράζεις ένα 10 λαχεία σε έκδοση 30000000 λαχνών. Νόμιμο παιχνίδι. Πιθανότητα νίκης :0,0000003
ΚΙΝΟ	Κληράνονται ηλεκτρονικά 20 από 80 αριθμούς και εσείς έχετε επιλέξει πριν την κλήρωση 1 έως 12 αριθμούς. Νόμιμο παιχνίδι. Πιθανότητα νίκης για σωστή πρόβλεψη 10 αριθμών :0,0000054
Οι υπολογισμοί αφορούν το μέγιστο χρηματικό βραβείο δίνουν (Λαχεία, προπό, τζόκερ,...)	

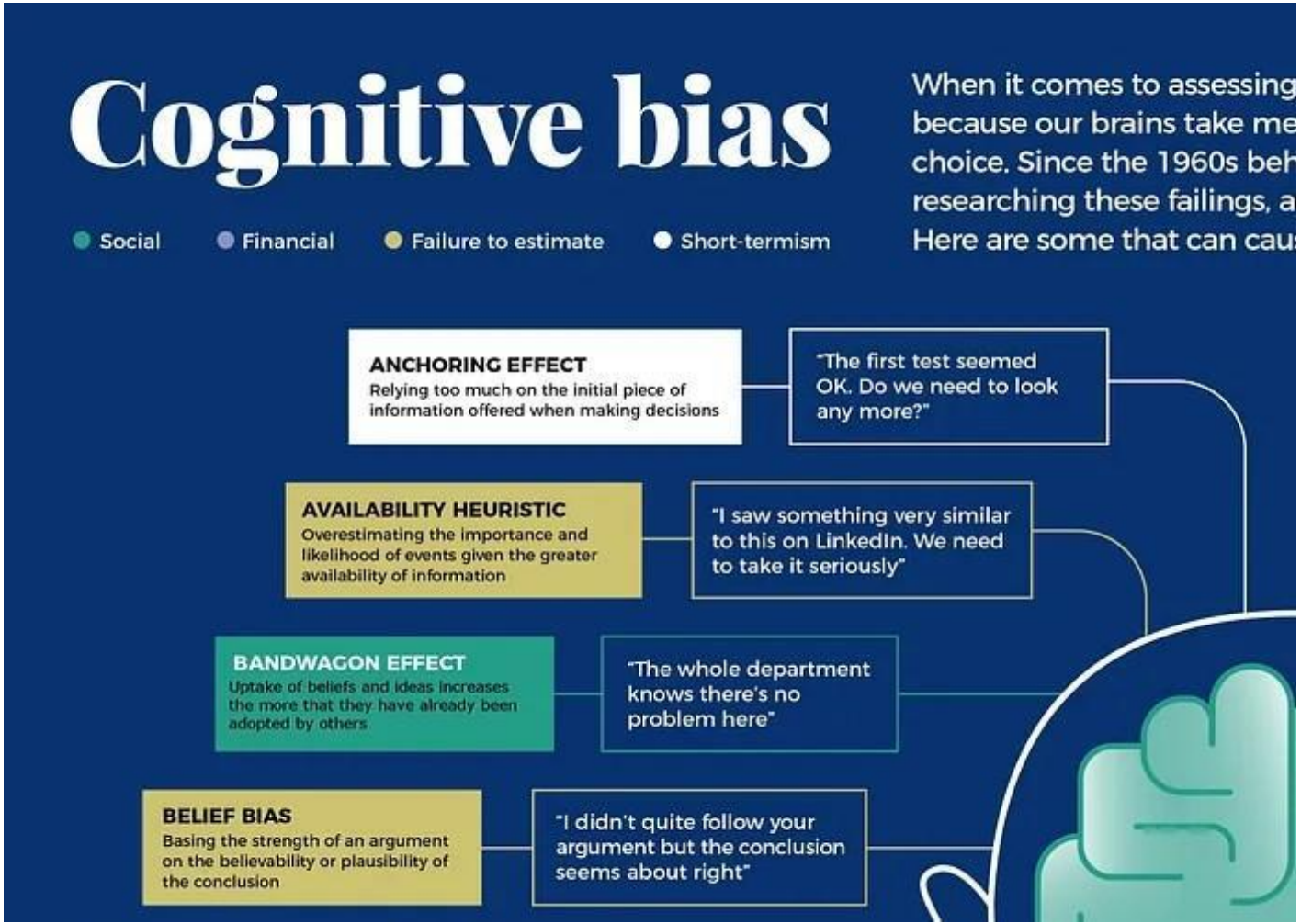
"Now for the evidence," said the King, "and then the sentence."

"No!" said the Queen, "first the sentence, and then the evidence!"

"Nonsense!" cried Alice, so loudly that everybody jumped, "the idea of having the sentence first!"

"Hold your tongue!" said the Queen.


Cognitive bias
Social
Financial
Failure to estimate
Short-termism
When it comes to assessing risk, humans often fail to make rational decisions because our brains take mental shortcuts that prevent us making the correct choice. Since the 1960s behavioural scientists and psychologists have been researching these failings, and have identified and labelled dozens of them. Here are some that can cause havoc when it comes to assessing risks in business
ORIGIN
The notion of cognitive biases was first introduced by psychologists Amos Tversky and Daniel Kahneman in the early-1970s. Their research paper, 'Judgment Under Uncertainty: Heuristics and Biases', in the Science journal has provided the basis of almost all current theories of decision-making and heuristics. Professor Kahneman was awarded a Nobel Prize in 2002 after further developing the ideas and applying them to economics.
ANCHORING EFFECT
Relying too much on the initial piece of information offered when making decisions
"The first test seemed OK. Do we need to look any more?"
AVAILABILITY HEURISTIC
Overestimating the importance and likelihood of events given the greater availability of information
"I saw something very similar to this on LinkedIn. We need to take it seriously"
BANDWAGON EFFECT
Uptake of beliefs and ideas increases the more that they have already been adopted by others
"The whole department knows there's no problem here"
BELIEF BIAS
Basing the strength of an argument on the believability or plausibility of the conclusion
"I didn't quite follow your argument but the conclusion seems about right"
BLIND SPOT BIAS
Viewing oneself as less biased than others
"Let's ignore Sarah's views on this one. She's biased"
CLUSTERING ILLUSION
Erroneously overestimating the importance of small clusters or patterns in large data
"This is the second week in a row that this has happened. There must be a problem"
CONFIRMATION BIAS
Focusing on information that only confirms existing preconceptions
"We did loads of simulations. Most of them showed there's no problem"
COURTESY BIAS
Giving an opinion/conclusion that is viewed as more socially acceptable so as to avoid causing offence/controversy
"The last time we discussed this the meeting lasted for hours. Let's move on"
ENDOWMENT EFFECT
The tendency for people to ascribe more value to things merely because they already own/have them
"I know it will cost a fortune to fix but it cost us £15,000. We can't just throw it away."
"The conveyor belt broke three times last month. It's pretty unlikely it'll happen again."
GAMBLER'S FALLACY
Believing that future probabilities are altered by past events, when in fact they are unchanged
"Let's just get the deal done ASAP"
HYPERBOLIC DISCOUNTING
Preferring a smaller, sooner payoff over a larger, later reward
"This worked fine in the factory in the Korea, it should work fine here"
ILLUSION OF VALIDITY
Overestimating our ability to make accurate predictions, especially when data appears to tell a coherent "story"
"Looks like we've run out of time to discuss this"
OSTRICH EFFECT
Avoiding negative financial information by pretending it doesn't exist
"We made a good call on that one"
POST-PURCHASE RATIONALISATION
Tendency to retroactively ascribe positive attributes to an option one has selected
"Our competitors are only doing well because their products are cheap"
REACTIVE DEVALUATION
Devaluing an idea because it originated from an adversary or opponent
"Now we've got the new equipment we can cut the time spent on maintenance"
RISK COMPENSATION
Taking bigger risks when perceived safety increases; being more careful when perceived risks increases
"If it ain't broke - don't fix it"
STATUS QUO BIAS
Preferring the current state of affairs over change
"Dave from tech is worried - but frankly the tech team are always pessimists"
STEREOTYPING
Assuming a person has characteristics because they are a member of a group
RACONTEUR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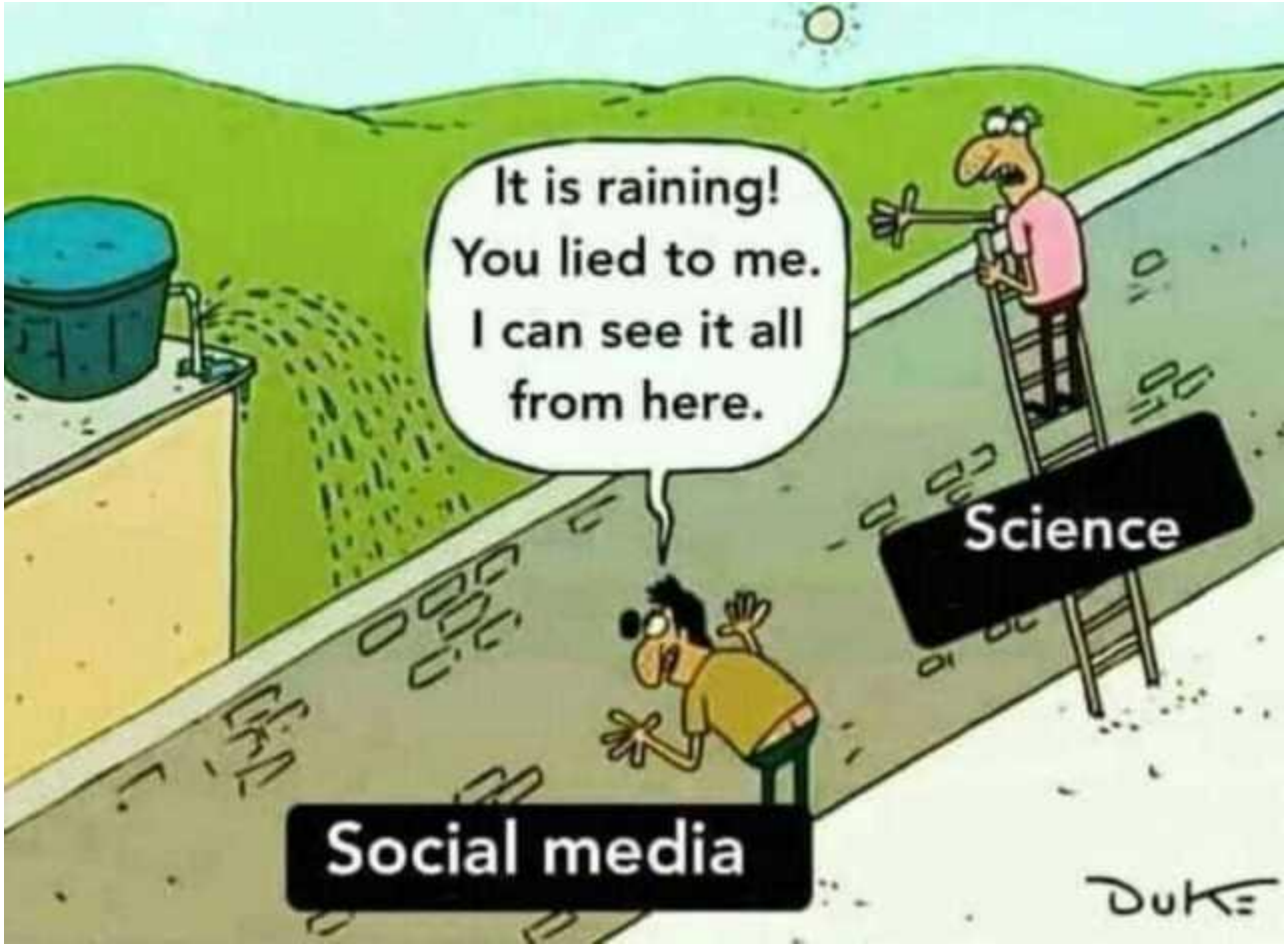
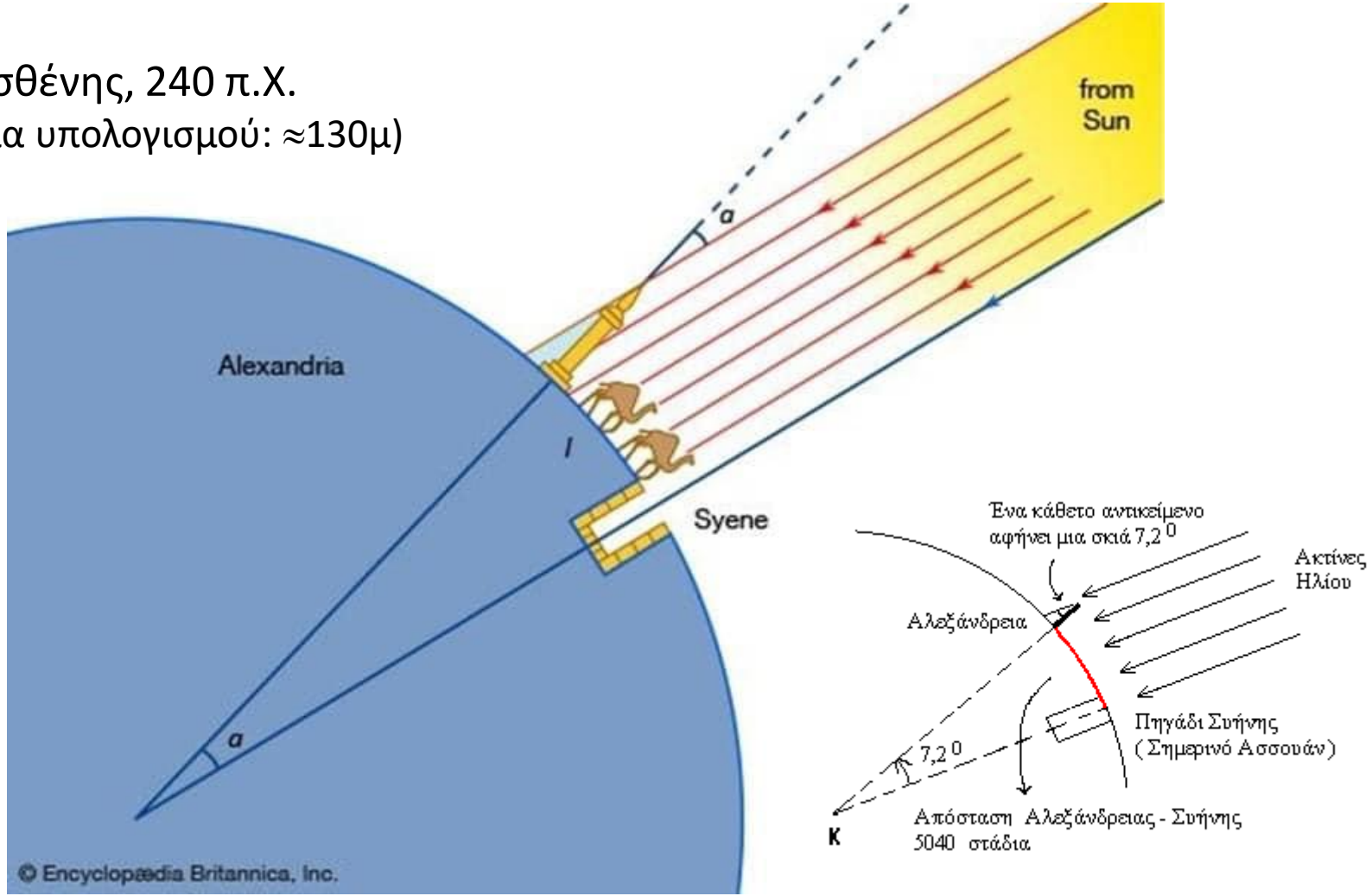
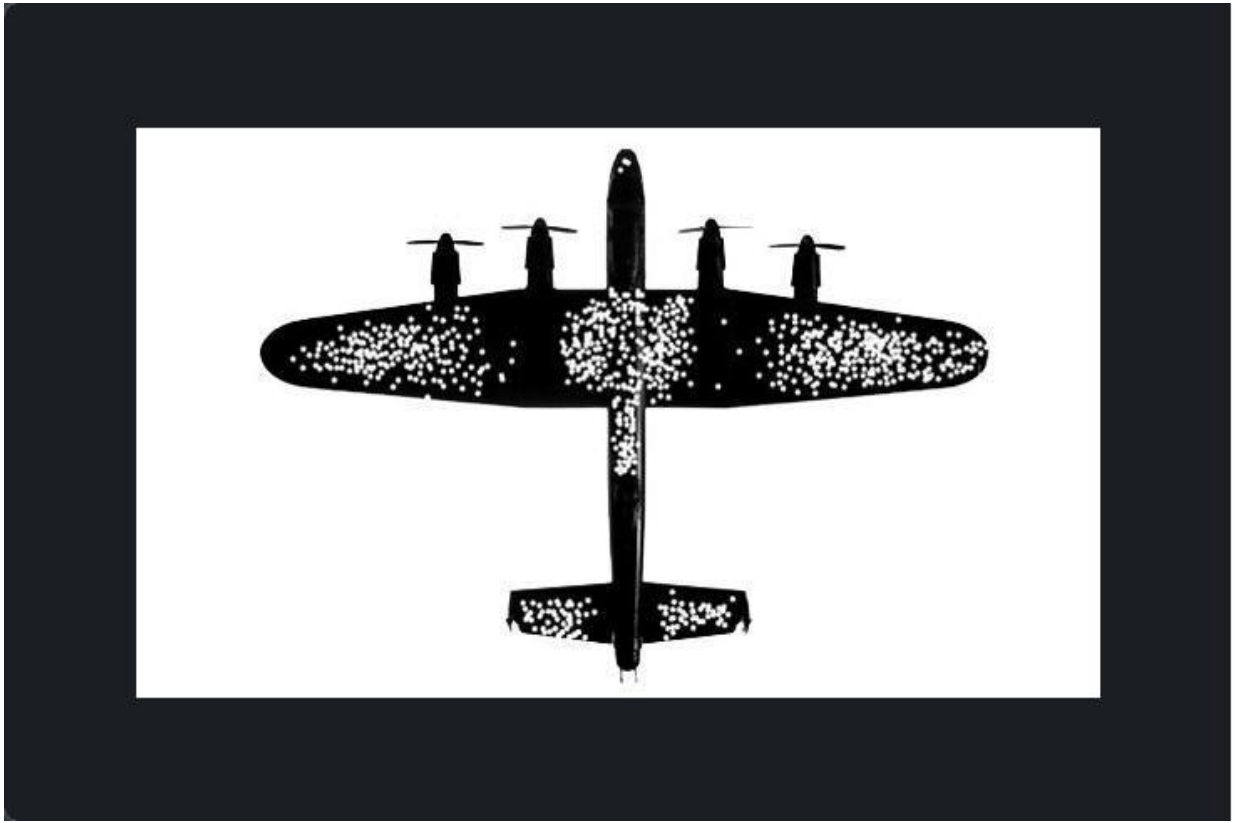

It is raining!
You lied to me.
I can see it all
from here.
Science
Social media
DUKE

Μέρος ΙΙ: Πρακτική Εφαρμογή

1. Πως σχεδιάζουμε τα μοντέλα;
2. Τι δεδομένα χρειαζόμαστε;
3. Πως γίνεται η αξιολόγηση;
4. Ένα πραγματικό παράδειγμα.

Ερατοσθένης, 240 π.Χ.
(σφάλμα υπολογισμού: ≈130μ)

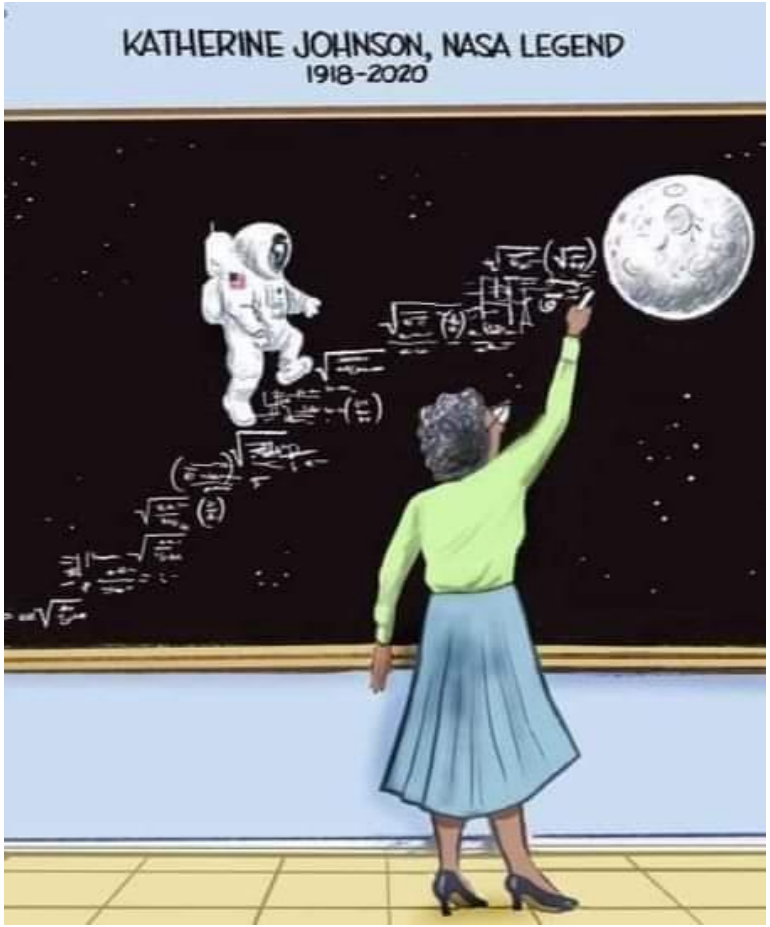


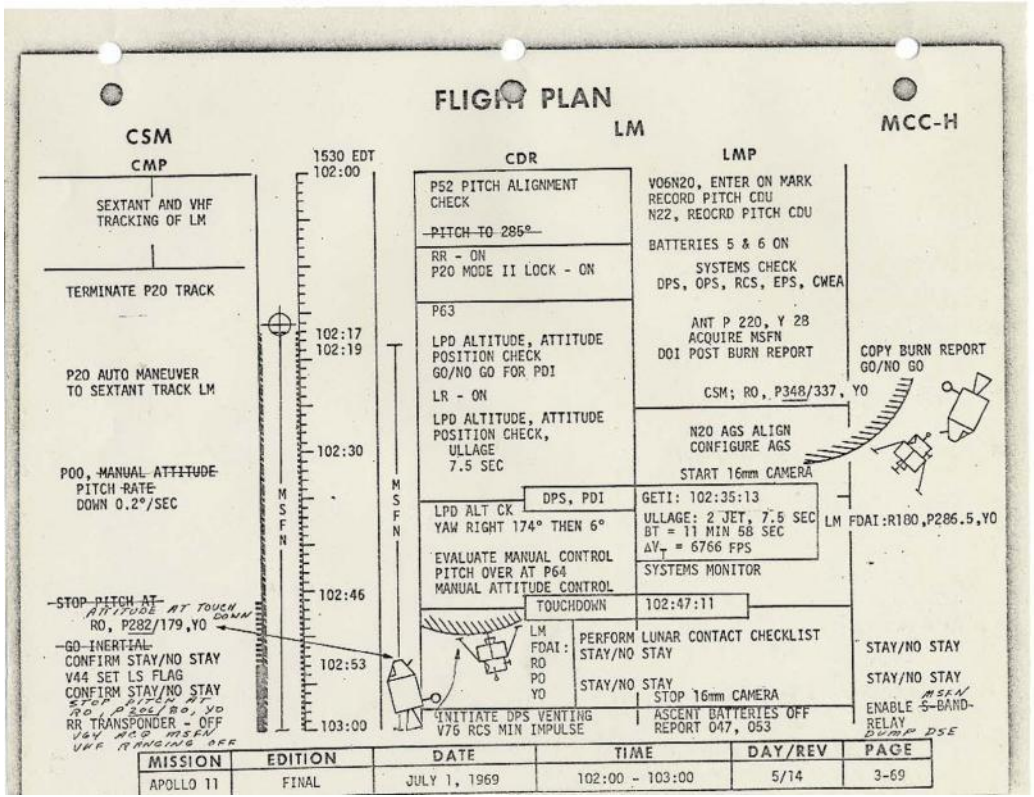


National Technical University of Athens
63,586 followers
13h • Edited •

αντιμετώπισαν ένα κρίσιμο πρόβλημα. Πολλά βομβαρδιστικά καταρρίφθηκαν σε διαδρομές πάνω από τη Γερμανία... Οι ερευνητές εστιάστηκαν στα δεδομένα αναζητώντας τρωτά σημεία. Τα δεδομένα άρχισαν να δείχνουν ένα σαφές μοτίβο (βλ. εικόνα). Οι περισσότερες ζημιές έγιναν στα φτερά και στο σώμα του αεροπλάνου. Η λύση στο πρόβλημά τους ήταν ξεκάθαρη: Αυξήστε την θωράκιση στα φτερά και στο σώμα του αεροπλάνου.

Όμως η ανάλυση ήταν εντελώς λάθος. Πριν τροποποιηθούν τα αεροπλάνα, ένας Ουγγρο-Εβραίος στατιστικολόγος ονόματι Abraham Wald εξέτασε τα δεδομένα. Η κριτική του Wald επεσήμανε ένα κρίσιμο ελάττωμα στην ανάλυση. Οι ερευνητές είχαν εξετάσει μόνο βομβαρδιστικά που είχαν επιστρέψει στη βάση. Από τα δεδομένα έλειπαν αυτά που αφορούσαν σε κάθε αεροπλάνο που είχε καταρριφθεί!


KATHERINE JOHNSON, NASA LEGEND
1918-2020


FLIGHT PLAN
CSM
LM
MCC-H
CMP
CDR
LMP
1530 EDT
102:00
SEXTANT AND VHF TRACKING OF LM
TERMINATE P20 TRACK
P20 AUTO MANEUVER TO SEXTANT TRACK LM
P00, MANUAL ATTITUDE PITCH RATE DOWN 0.2°/SEC
STOP PITCH AT ATTITUDE AT TOUCH DOWN RO, P282/179, YO
GO INERTIAL
CONFIRM STAY/NO STAY
V44 SET LS FLAG
CONFIRM STAY/NO STAY
RR TRANSPONDER - OFF
VHF RNG OFF
P52 PITCH ALIGNMENT CHECK
PITCH TO 285°
RR - ON
P20 MODE II LOCK - ON
P63
LPD ALTITUDE, ATTITUDE POSITION CHECK GO/NO GO FOR PDI
LR - ON
LPD ALTITUDE, ATTITUDE POSITION CHECK, ULLAGE 7.5 SEC
LPD ALT CK
YAW RIGHT 174° THEN 6°
EVALUATE MANUAL CONTROL PITCH OVER AT P64 MANUAL ATTITUDE CONTROL
INITIATE DPS VENTING
V76 RCS MIN IMPULSE
V06N20, ENTER ON MARK RECORD PITCH CDU N22, RECORD PITCH CDU
BATTERIES 5 & 6 ON
SYSTEMS CHECK DPS, OPS, RCS, EPS, CWEA
ANT P 220, Y 28 ACQUIRE MSFN DOI POST BURN REPORT
CSM: RO, P348/337, YO
N20 AGS ALIGN CONFIGURE AGS
START 16mm CAMERA
DPS, PDI
GETI: 102:35:13
ULLAGE: 2 JET, 7.5 SEC
BT = 11 MIN 58 SEC
ΔVT = 6766 FPS
SYSTEMS MONITOR
TOUCHDOWN 102:47:11
LM FDAI: RO PO YO
PERFORM LUNAR CONTACT CHECKLIST STAY/NO STAY
STAY/NO STAY
STOP 16mm CAMERA
ASCENT BATTERIES OFF REPORT 047, 053
COPY BURN REPORT GO/NO GO
LM FDAI: R180, P286.5, YO
STAY/NO STAY
STAY/NO STAY
ENABLE MSFN S-BAND RELAY
DUMP PSE
102:17
102:19
102:30
102:46
102:53
103:00
MSFN
MSFN
MISSION
EDITION
DATE
TIME
DAY/REV
PAGE
APOLLO 11
FINAL
JULY 1, 1969
102:00 - 103:00
5/14
3-69

"Ναι, αλλά πώς ξέρουμε ότι πραγματικά πήγαμε στη Σελήνη;"
Η αποστολή της Ινδίας στη Σελήνη φωτογράφησε εχθές τα δύο οχήματα προσεδάφισης (LM modules) των Apollo 11 και 12. Αναπαύονται ειρηνικά εκεί, στα σημεία που ακούμπησαν πριν πολλές δεκαετίες. Είναι η δεύτερη αποστολή που καταγράφει τέτοιες φωτογραφίες. Έχουμε δηλαδή διαφορετικά κράτη, με ανεξάρτητες αποστολές, να επιβεβαιώνουν hard evidence. Και αυτό λοιπόν είναι λίγο-πολύ ο τρόπος που στην επιστήμη λειτουργεί το peer-review.

CONTACT LIGHT. @contactlight69 · 12h

Pleased to see that India's Chandrayaan 2 spacecraft has returned these images of the #Apollo11 & 12 landing sites. Now lunar orbiting spacecraft of two nations have captured the LM descent stages resting peacefully decades after they sent humans to another world.

Data science vs. AI vs. ML

Data Science

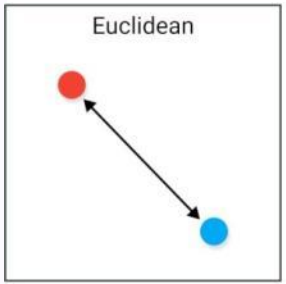
- based on strict analytical evidence
- deals with structured & unstructured data
- includes various data operations

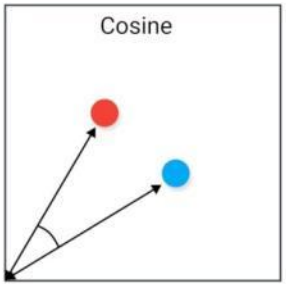
Artificial Intelligence

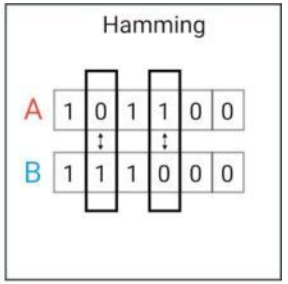
- imparts human intellect to machines
- uses logic and decision trees
- includes machine learning

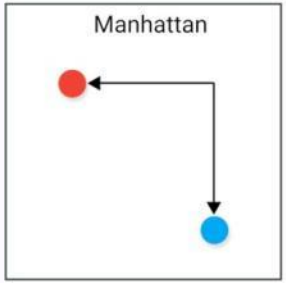
Machine Learning

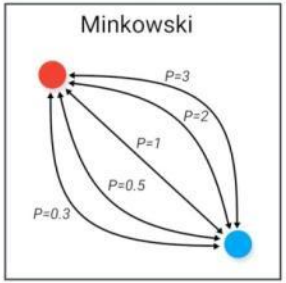
- subset of AI
- uses statistical models
- machines improve with experience

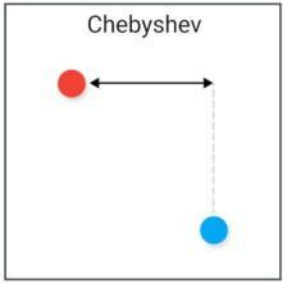


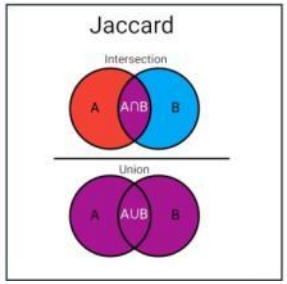


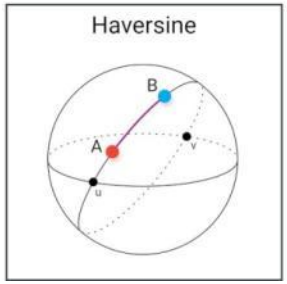


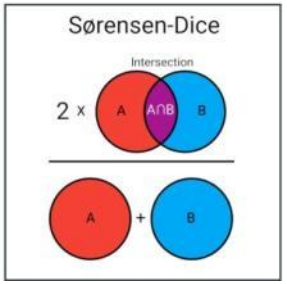












A Rough Guide to
SPOTTING BAD SCIENCE
Being able to evaluate the evidence behind a scientific claim is important. Being able to recognise bad science reporting, or faults in scientific studies, is equally important. These 12 points will help you separate the science from the pseudoscience.
1. SENSATIONALISED HEADLINES
Article headlines are commonly designed to entice viewers into clicking on and reading the article. At times, they can over-simplify the findings of scientific research. At worst, they sensationalise and misrepresent them.
7. UNREPRESENTATIVE SAMPLES USED
In human trials, subjects are selected that are representative of a larger population. If the sample is different from the population as a whole, then the conclusions from the trial may be biased towards a particular outcome.
2. MISINTERPRETED RESULTS
News articles can distort or misinterpret the findings of research for the sake of a good story, whether intentionally or otherwise. If possible, try to read the original research, rather than relying on the article based on it for information.
8. NO CONTROL GROUP USED
In clinical trials, results from test subjects should be compared to a 'control group' not given the substance being tested. Groups should also be allocated randomly. In general experiments, a control test should be used where all variables are controlled.

3. CONFLICTS OF INTEREST

Many companies will employ scientists to carry out and publish research - whilst this doesn't necessarily invalidate the research, it should be analysed with this in mind. Research can also be misrepresented for personal or financial gain.

4. CORRELATION & CAUSATION

Be wary of any confusion of correlation and causation. A correlation between variables doesn't always mean one causes the other. Global warming increased since the 1800s, and pirate numbers decreased, but lack of pirates doesn't cause global warming.

5. UNSUPPORTED CONCLUSIONS

Speculation can often help to drive science forward. However, studies should be clear on the facts their study proves, and which conclusions are as yet unsupported ones. A statement framed by speculative language may require further evidence to confirm.

6. PROBLEMS WITH SAMPLE SIZE

In trials, the smaller a sample size, the lower the confidence in the results from that sample. Conclusions drawn can still be valid, and in some cases small samples are unavoidable, but larger samples often give more representative results.

9. NO BLIND TESTING USED

To try and prevent bias, subjects should not know if they are in the test or the control group. In 'double blind' testing, even researchers don't know which group subjects are in until after testing. Note, blind testing isn't always feasible, or ethical.

10. SELECTIVE REPORTING OF DATA

Also known as 'cherry picking', this involves selecting data from results which supports the conclusion of the research, whilst ignoring those that do not. If a research paper draws conclusions from a selection of its results, not all, it may be guilty of this.

11. UNREPLICABLE RESULTS

Results should be replicable by independent research, and tested over a wide range of conditions (where possible) to ensure they are consistent. Extraordinary claims require extraordinary evidence - that is, much more than one independent study!

12. NON-PEER REVIEWED MATERIAL

Peer review is an important part of the scientific process. Other scientists appraise and critique studies, before publication in a journal. Research that has not gone through this process is not as reputable, and may be flawed.

Peer Review Criteria Guide

Peer Review Process

PRIZREN SOCIAL SCIENCE JOURNAL

A STANDERD PROTOCOL

This is the simple version of a complex protocol

Created by Name (ill) abv1@uni.ac.uk) on October 2, 2017
Edditted by John Smith (ill) abv1@uni.ac.uk) on October 3, 2017

Last edit December 10, 2017

LaTeX

Protocol purpose:
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nunc porta dui a fermentum varius. Aliquam cursus urna sit amet urna sollicitudin, vel pellentesque turpis imperdiet. Aenean lectus neque, rhoncus vel.

PROTOCOL

Step 1 [Time required 20 minutes]

Lorem ipsum dolor sit amet, consectetur

- Take one of x and then
- Then do the next thing
- Then do the next thing
- Then do the next thing

Step 2 [Time required 35 minutes]

Pellentesque habitant morbi tristique senectus

- Then do the next thing
- Then do the next thing
- Then do the next thing

Step 3 [Time required 40 minutes]

habitant morbi tristique senectus

- Then do the next thing
- Then do the next thing

Step 4 [Time required 25 minutes]

Ut quis orci luctus, efficitur sem vitae

- Do this using the method in the bib file (Einstein 1905)
- Then do the next thing

Step 5 [Time required 30 minutes]

orbi tristique senectus

- Then do the next thing
- Then do the next thing
- Then do the next thing

Step 6 [Time required 15 minutes]

ipsum dolor sit amet

- Then do the next thing as done by Einstein 1905
- Then do the next thing
- Then do the next thing
- Then do the next thing

EQUIPMENT

(n) petri dishes | Some things | Stuff

other | more | used before (would do) | twesors

CEMICALS

100% H_2O | 25% H_2O

Some chemicals | Some H_2SO_4

DANGERS

Chemicals
Phisical
Environmental

PROTECTIVE GEAR

Laboratory Coat | Gloves | boots

SOURCES

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WARNINGS

Chemical
The H_2SO_4 is bad for you

Bugs
The bugs will be attracted to the H_2O

NOTES

PEOPLE TO CONTAT

Jame and Sam (about chemicals)

Ένα πραγματικό πρόβλημα...

Βήμα 1: Παρατήρηση – Καταγραφή Δεδομένων

Fig. 3. MetroTransit dataset generated by the CR-GTFS pipeline.

Βήμα 2: Ερώτηση – Καθορισμός Προβλήματος

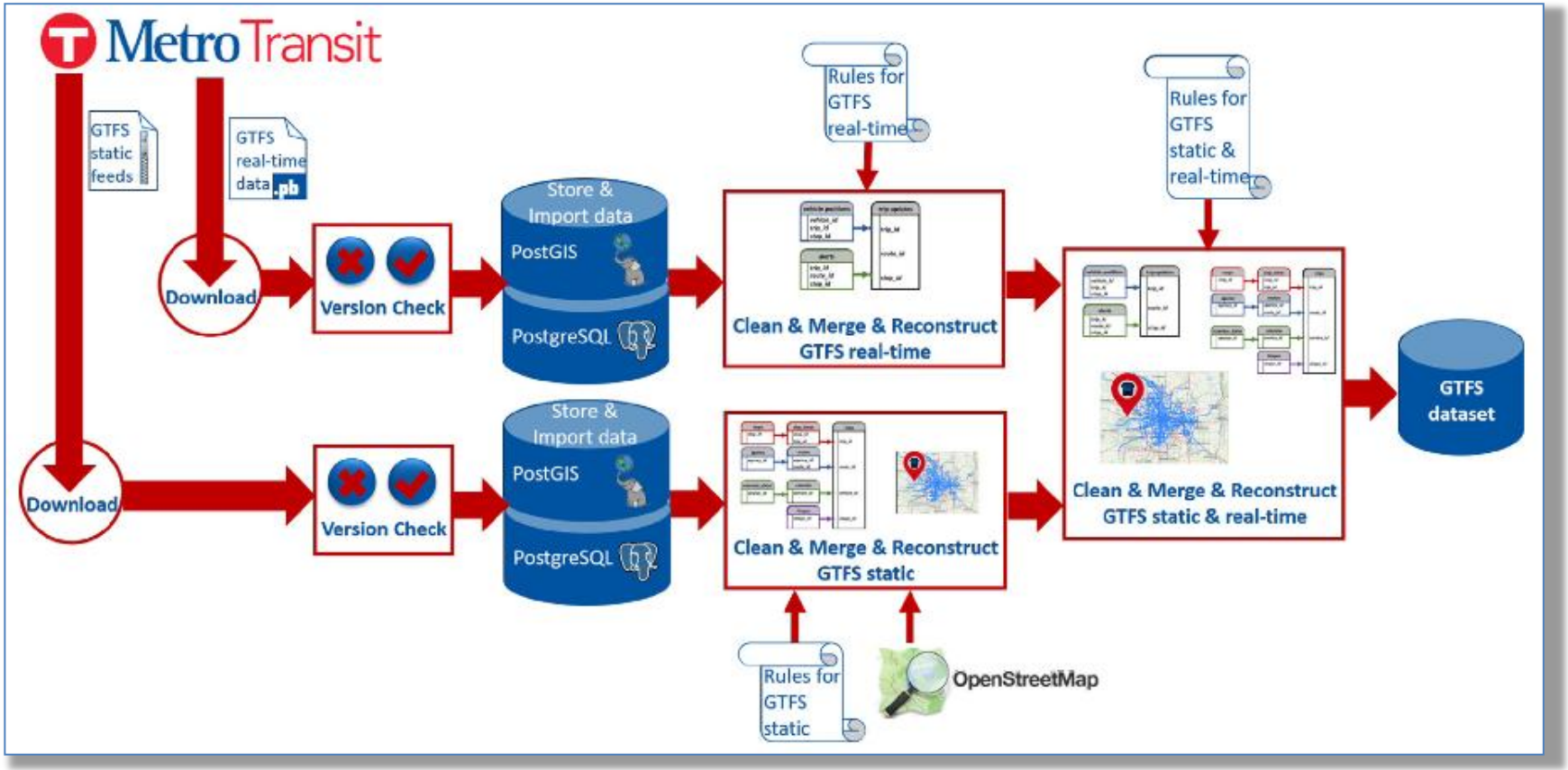
3. Problem formulation

Using a GTFS dataset, the PT-ETA prediction task can be stated as follows:

- **Given**: an input vector $\mathbf{u}' = [u'_{t_s-k_s}, \ldots, u'_{t_s-1}, \tilde{u}'_{t_s,\, t_s+q}]$, where t_s is the current vehicle stop, u'_{t_s-b} contains sequential information about passing through stop $t_s - b$, $b \in \{0, \ldots, k_s\}$ and $\tilde{u}'_{t_s,\, t_s+q}, q > 0$ contains information about current stop t_s and future vehicle stop $t_s + q$,
- **Predict**: the arrival time or $dT_{t_s,\, t_s+q}$ towards a future vehicle stop q in sequence.

Further analysis and details concerning the problem formulation can be found in Appendix A.

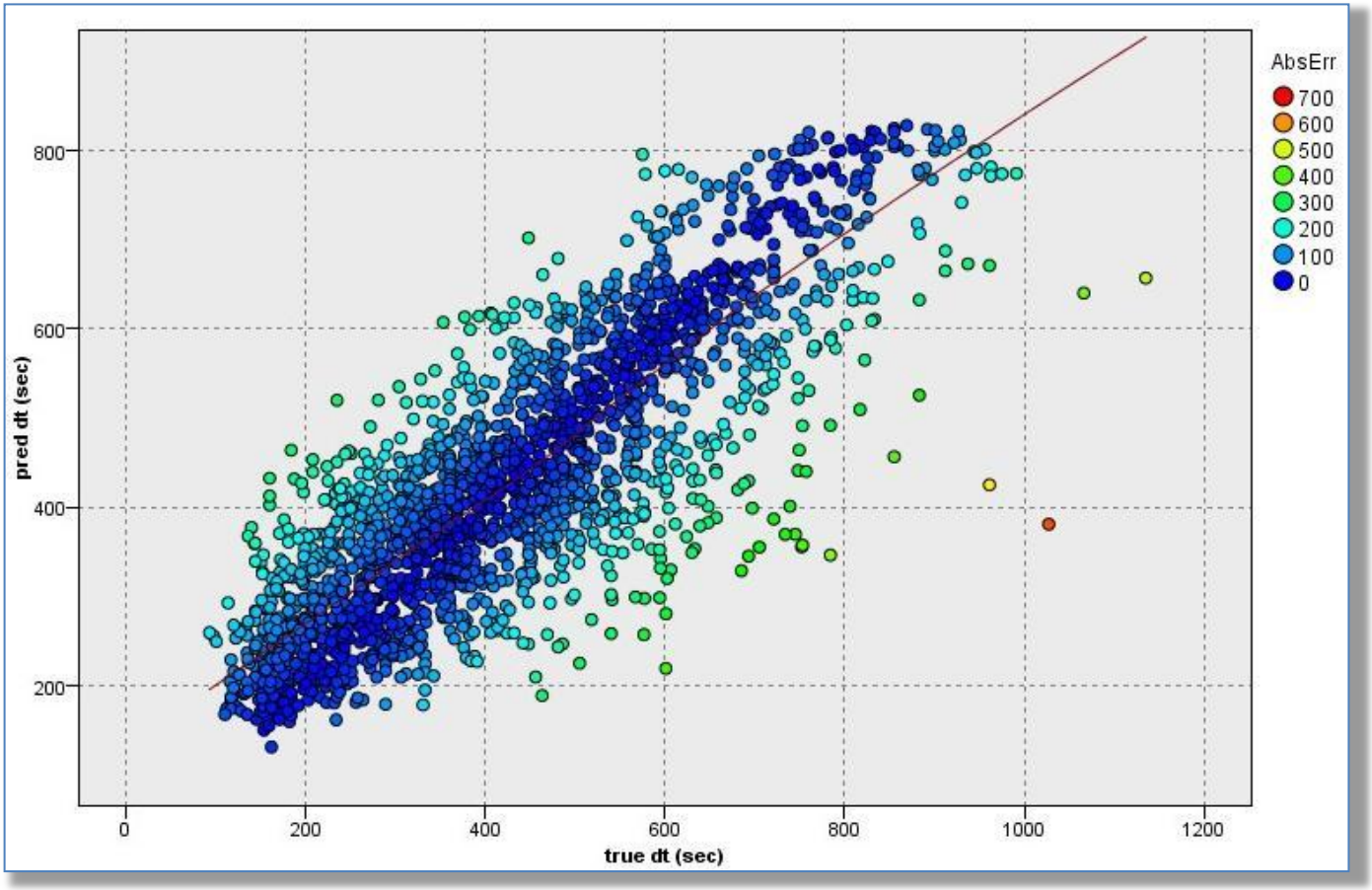
Βήμα 3: Υπόθεση – Σχεδίαση Μοντέλων



Βήμα 4: Πρόβλεψη – Εφαρμογή Μοντέλων

Method	RMSE	R^2	MAE
ELM (SIG)	88.596±2.084	0.733±0.009	65.584±1.333
CART	86.943±0.669	0.744±0.004	63.497±0.462
SVR	83.969±1.669	0.763±0.009	60.799±0.618
LSBoost	81.773±0.163	0.774±0.002	59.872±0.172
MLP	81.148±1.378	0.777±0.008	59.451±0.454
RBF-SFM	80.539±0.125	0.781±0.001	59.372±0.127
modified PSO-NSFM	**79.067**±0.147	**0.786**±0.001	**58.978**±0.141

Βήμα 5: Πειραματική Δοκιμή – Επιβεβαίωση



Βήμα 6: Αξιολόγηση – Βελτίωση

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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Σύνοψη

- Περιεχόμενα:
  - Τι είναι η «Επιστημονική Μεθοδολογία» στις Θετικές Επιστήμες.
  - Γιατί η παρατήρηση και η πειραματική αξιολόγηση είναι σημαντικοί παράγοντες.
  - Ποια είναι τα προβλήματα και οι κίνδυνοι στη σχεδίαση και στην εφαρμογή.
  - Επεξήγηση με ένα πραγματικό πρόβλημα-παράδειγμα:
    - *«Πρόβλεψη χρόνου άφιξης λεωφορείων στις προγραμματισμένες στάσεις»*
- Αναφορές:
  - «Εισαγωγή στη Μηχανική Μάθηση και στην Αναλυτική Δεδομένων», Χ. Γεωργίου, Α’ κύκλος ανοικτών μαθημάτων ΕΠΕ – https://youtu.be/mlU4SvyfRqA
  - «Εφαρμογές της Τεχνητής Νοημοσύνης στον πραγματικό κόσμο», Χ. Γεωργίου, Α’ κύκλος ανοικτών μαθημάτων ΕΠΕ – https://youtu.be/d2HnlWyQse4
  - «Particle Swarm Optimization and RBF Neural Networks for public transport arrival time prediction using GTFS data», E. Chondrodima, H. Georgiou, N. Pelekis, Y. Theodoridis. *International Journal of Information Management Data Insights (IJIMDI), Vol. 2, Issue 2, Nov. 2022, 100086* (doi: 10.1016/j.jjimei.2022.100086)

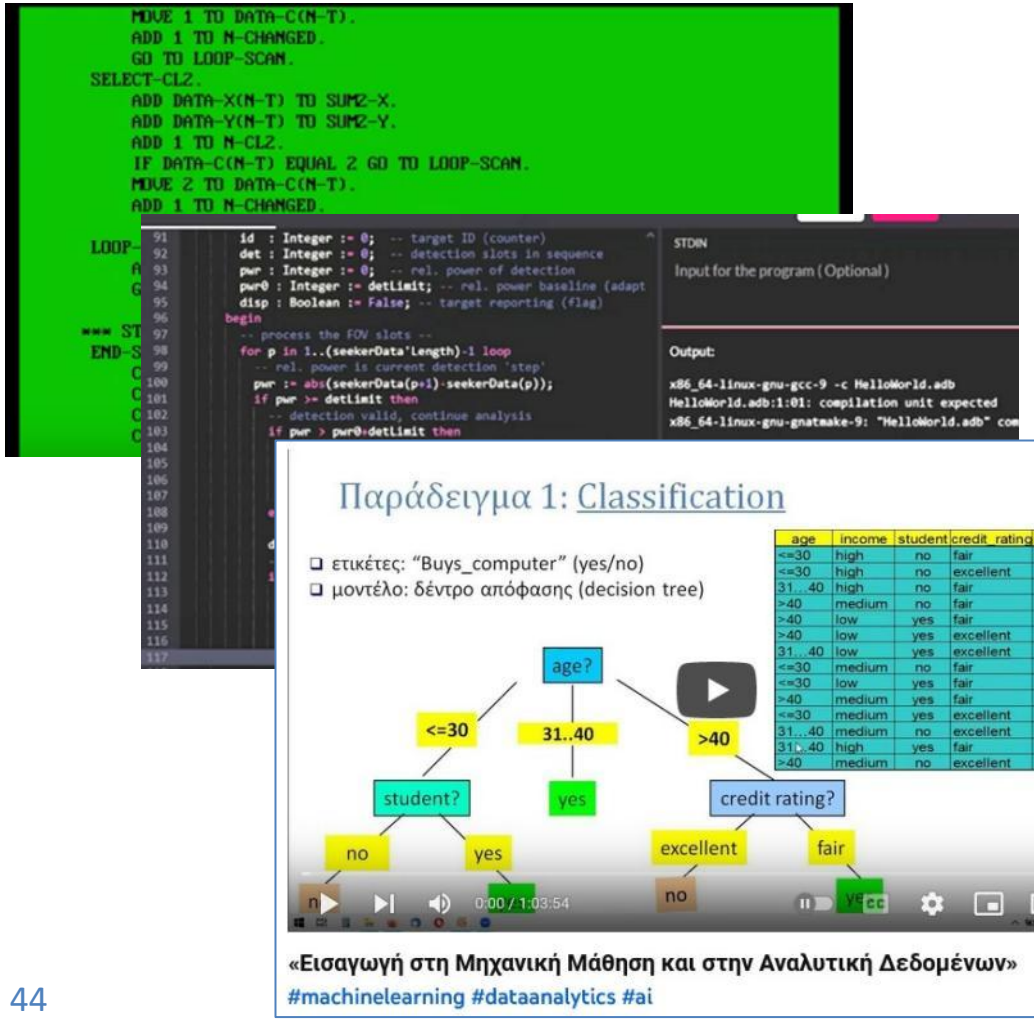
Ένας ψηφιακός κόσμος γεμάτος γνώση για όλους

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.



- 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.eu

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