What do you want to do with AI today?

AlphaFold 3 predicts the structure and interactions of all of life's molecules

Introducing AlphaFold 3, a new AI model developed by Google DeepMind and Isomorphic Labs. By accurately predicting the structure of proteins, DNA, RNA, ligands and more, and how they interact, we hope it will transform our understanding of the biological world and drug discovery.

May 08, 2024   ·   6 min read   ⤳ Share

May 13, 2024

Hello GPT-4o

We're announcing GPT-4o, our new flagship model that can reason across audio, vision, and text in real time.

https://openai.com/index/hello-gpt-4o/

https://blog.google/technology/ai/google-deepmind-isomorphic-alphafold-3-ai-model/

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Contents

A quick introduction to AI

AI & ~~Survivability~~ Sustainability

An introduction to Information Wisdom Theory

Four types of AI

Think like human	Think rationally
Act like human	Act rationally

Russel & Norvig (2010), Artificial Intelligence, A modern approach. 3rd ed.
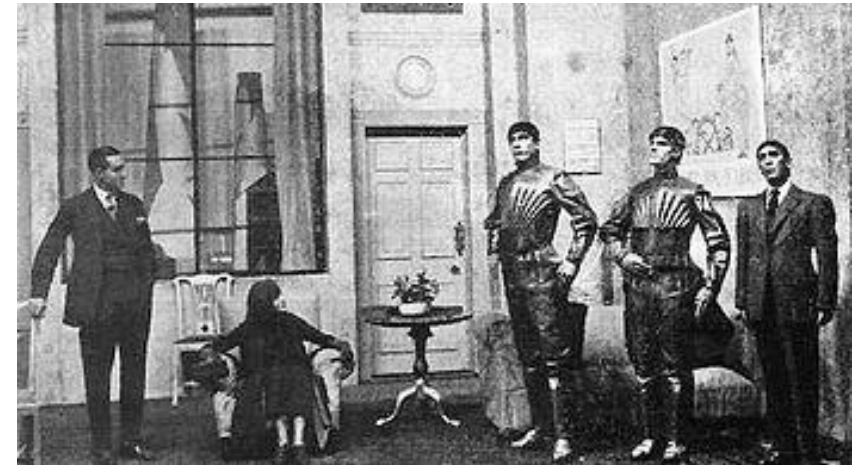
Brief history (pictures from Wikipedia)
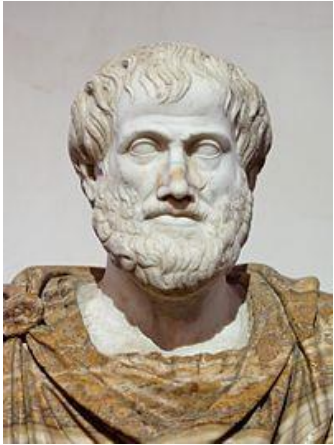
Aristotle
(BC384-BC322)
proposed rationality.

Thomas Bayes
(1702-1761)
introduced the
Bayes' Theorem.

A novel "Frankenstein"
by Mary Shelley, 1818,
questions artificial life.

Play R.U.R (Rossum's Universal Robots, 1920) introduced "robot" from Czech-language to English for "forced labor."

Turing Test（1950）

"BENEDICT CUMBERBATCH IS OUTSTANDING"
★★★★

"A SUPERB THRILLER" ★★★★   "THE BEST BRITISH FILM OF THE YEAR" ★★★★★   "AN INSTANT CLASSIC" ★★★★★

THE TRUE ENIGMA WAS THE MAN WHO CRACKED THE CODE

BENEDICT CUMBERBATCH   KEIRA KNIGHTLEY

THE IMITATION GAME

IN CINEMAS NOVEMBER 14

https://en.wikipedia.org/w/index.php?curid=56682373

VOL. LIX.   No. 236.]   [October, 1950

MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINERY AND INTELLIGENCE

BY A. M. TURING

1. *The Imitation Game.*

I PROPOSE to consider the question, 'Can machines think ?'

Birth of modern AI

1956 Dartmouth Conference: The Founding Fathers of AI

John MacCarthy   Marvin Minsky   Claude Shannon   Ray Solomonoff   Alan Newell

Herbert Simon   Arthur Samuel   Oliver Selfridge   Nathaniel Rochester   Trenchard More

"... make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves."
— McCarthy et al., Aug 31, 1955

https://medium.com/rla-academy/dartmouth-workshop-the-birthplace-of-ai-34c533afe992

7

Machine Learning: Key of today's AI

- Assuming the data follows a law y = f(x), ML is to find the optimal parameters that decide f from known data (= learn) and uses it to predict unknown data.
- E.g., linear regression: f(x) = ax + b; deep learning: f is defined by a multi-layer artificial neural network; etc.
- *ML is considered valid to human too.
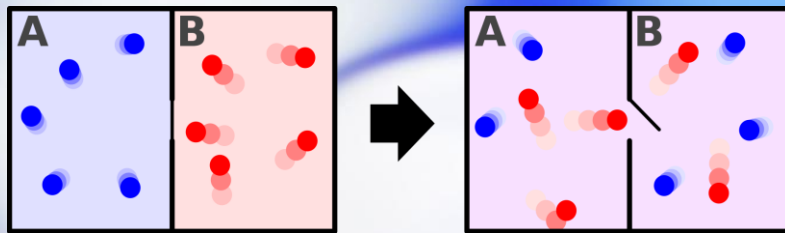
An example of linear regression

8
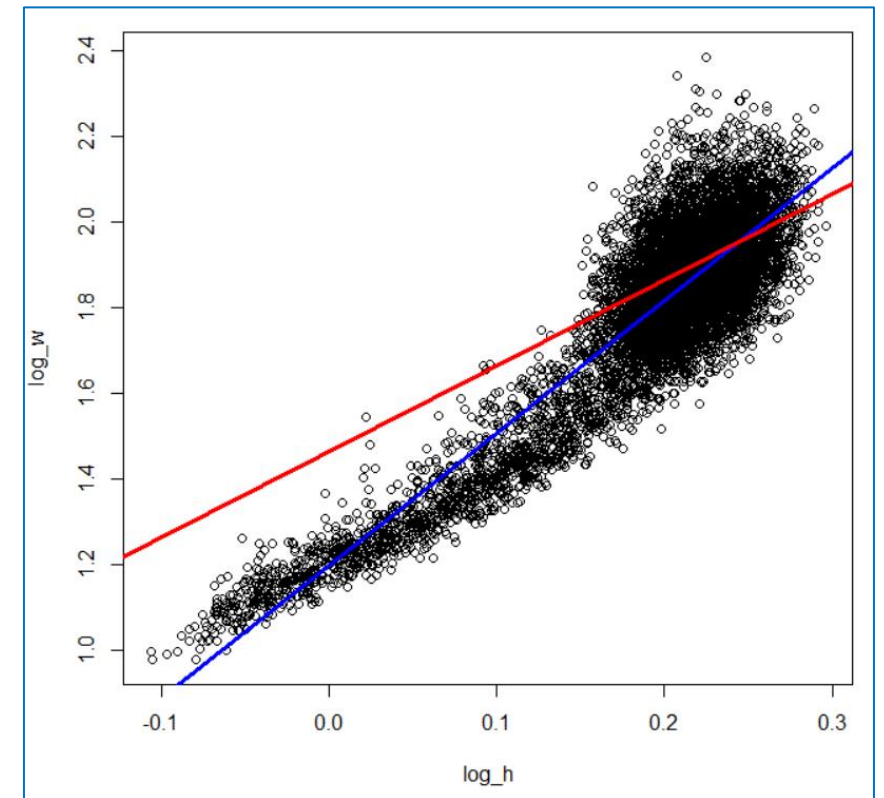
AI & Sustainability

Second Law of Thermodynamics (Wikipedia)

(Clausius) It is impossible to transfer heat from a colder object to a hotter object without any change. (Planck) Every process in the nature increases the entropy of the system.

Entropy: a measurable quantity associated with a state of disorder, randomness, freedom, or uncertainty of a system.

- Thermodynamics (Clausius, 1865)

- Statistical mechanics (Gibbs, 1878)

- Information theory (Shannon, 1949)

What is sustainability

- Classical view of life: body + spirit
    - **body (matter): follow laws of nature**
    - **spirit: does not follow them**
- Science (biology) view: reproduction + metabolism + cell
- Schrodinger's view (1944): Life does not follow the Second Law of Thermodynamics with metabolism.

Sustainability is to slow down the process toward the collapse of the Earth, even though it (the collapse) cannot be avoided.

Information is more important to life

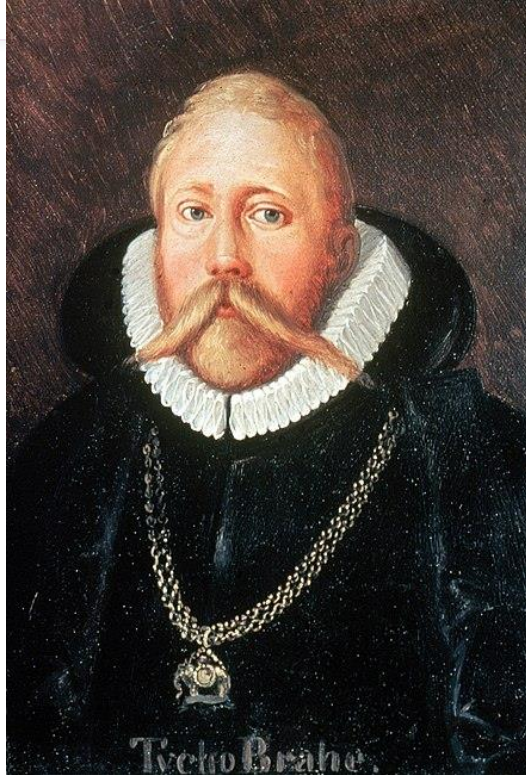https://www.nature.com/articles/d41587-022-00001-5
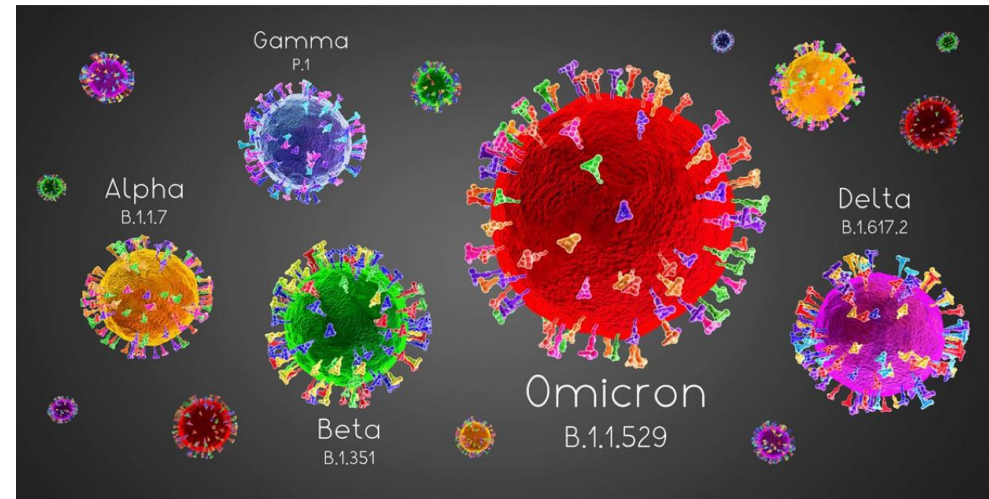
Genetic information processing is the most fundamental feature of life: Mutation increases the information entropy (the natural side) and heredity passes "good" information to the next generation (the life-like side).

Thus, virus is also life (I think).
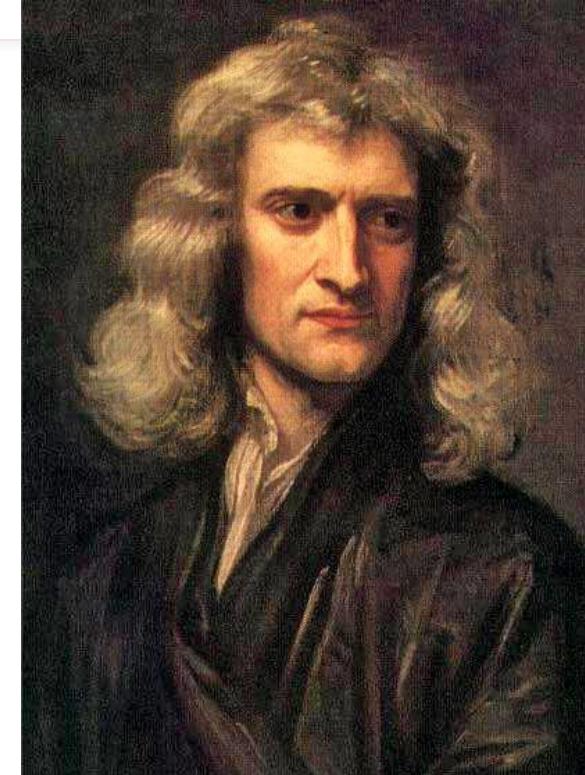
Information metabolism by brain

Brahe
(Big Data)

Kepler
(Three laws of
planetary motion)

Newton
(Law of universal
gravitation)

Small Data & AI for sustainability

Data is not sustainable (nature side)

Data -> "good" information is a must (life side)

I propose Small Data for sustainability

Keep data collecting, saving, transferring etc to the minimal level.

Consider data deletion as a step of data management (c.f. right to be forgotten)

Value good information and theory more than data. -> AI

Notice that AI is not free (as predicted)

https://www.nikkei.com/article/DGKKZO79934590Q4A410C2EP0000/

"The power consumption is expected to increase by 40% in 2050 due to the unexpected spread of generative AI."
— Nikkei, April 11, 2024

Recall the observation by Schrodinger (1944).

An introduction to Information Wisdom Theory

What is life

- Schrodinger's observation (1944): Life does not follow the Second Law of Thermodynamics which is a law of nature stating that every process in the nature increases the entropy of the system.

- Entropy: a measurable quantity associated with a state of disorder, randomness, freedom, or uncertainty of a system.

- => Nature increases disorder (i.e., disorder is *natural*).

- => Nature gave life freedom, but life uses it to find order.

プルチックの感情の輪

三次元

感情の強さ

Why? Because nature gives life disorder.

Psychology: We were **born** with **more negative** emotions.
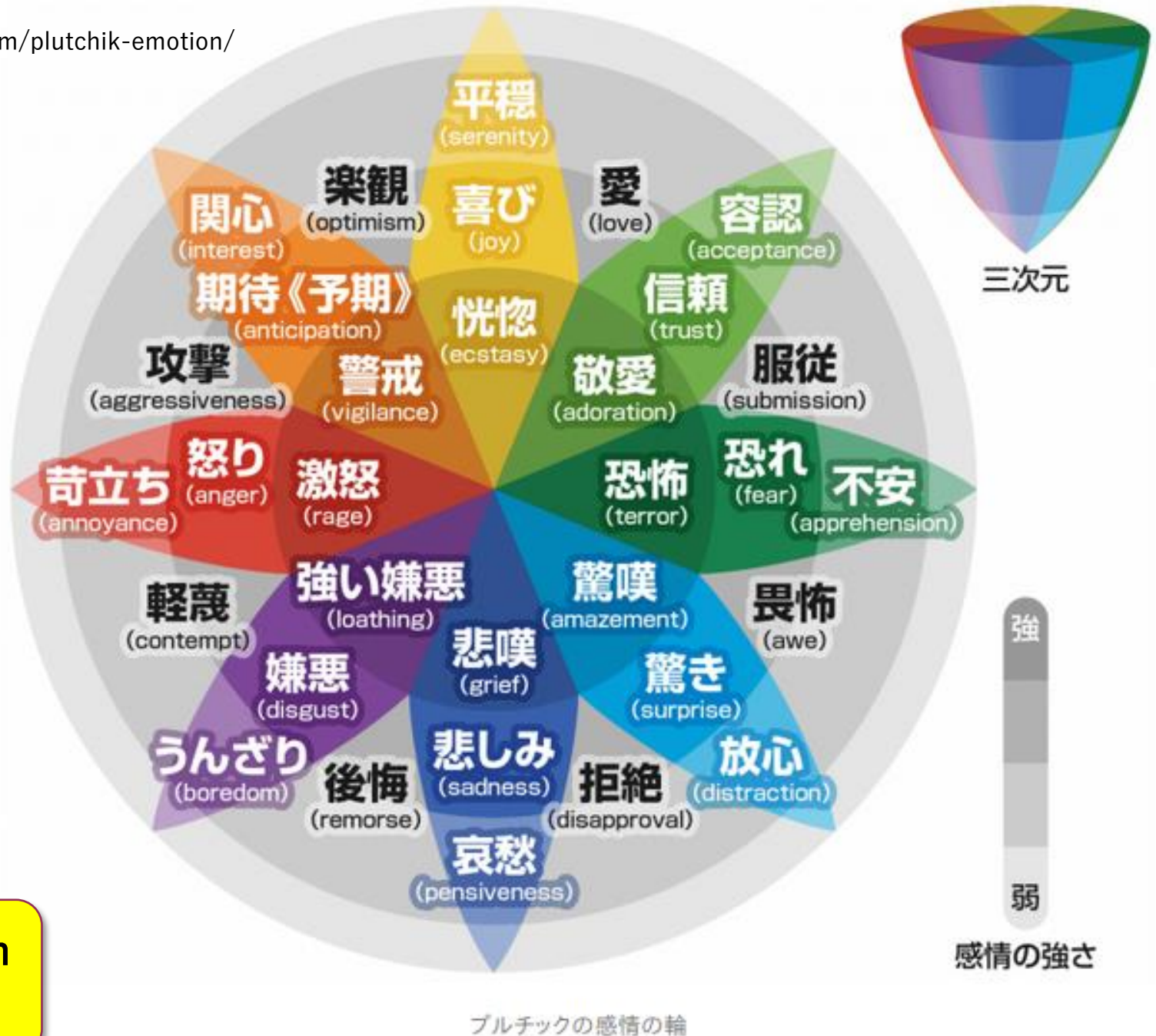
On the contrary, life tries to find order.

https://tetris.com/play-tetris/

What Makes Tetris so Incredibly Addictive?

Posted June 27, 2017 6:49 AM, Morgan Shaver
In #Feature, #Life

Believe it or not, there's a perfectly good reason why you can't stop playing the world's greatest puzzle game.

Tetris celebrated its 30th anniversary in 2014. Speaking to its longevity, the game's creator, Alexey Pajitnov, said that, "Tetris is a very simple game, but it appeals to many players because it's both visually and intellectually challenging."

"I think that's what makes the game so addictive. We have an inherent desire to create order out of chaos, and Tetris satisfies that desire on a very basic level, while being easy to understand and quick to learn."

https://tetris.com/article/44/what-makes-tetris-so-incredibly-addictive

Wisdom as the wisdom for living

Act wisely (wisdom as action) = Learn + Do random selection
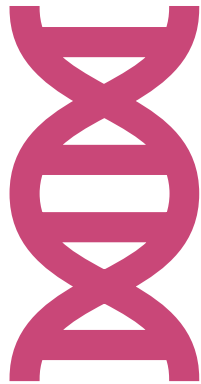
Heredity and mutation (life 1.0)

Learning and doing random selection with brain (life 2.0)

Evidence from Neuroscience

サライアンス・ネットワーク

Salliance network

前

島皮質

デフォルト・モード・ネットワークとエグゼクティブ・コントロール・ネットワークの仲介役

Switch two networks

左　右

前帯状皮質

後

Default mode network

Executive control network

デフォルト・モード・ネットワーク

エグゼクティブ・コントロール・ネットワーク

自由で創造的な思考・発想を広げるときに活動

明確なゴールのある思考の際に活動

Activated for free, creative works

Activated for goal-guided works

前頭前皮質内側部

前頭前皮質背外側部

反相関

後帯状皮質

後頭頂皮質

大黒達也 (2021), https://www.adeccogroup.jp/power-of-work/220

Evidence from Kyodai style

「京都大学は、創立以来築いてきた自由の学風を継承し、発展させつつ、多元的な課題の解決に挑戦し、地球社会の調和ある共存に貢献するため、自由と調和を基礎に、ここに基本理念を定める。」

https://www.kyoto-u.ac.jp/ja/about/operation/ideals/basic

Cycle of doing research

frontier researches

... information → information → information → information

initial state

Increase info. entropy
by random selecting
and greedy sensing

Reduce info. entropy
by random selecting
and greedy learning

Growth of information
(the nature of life)
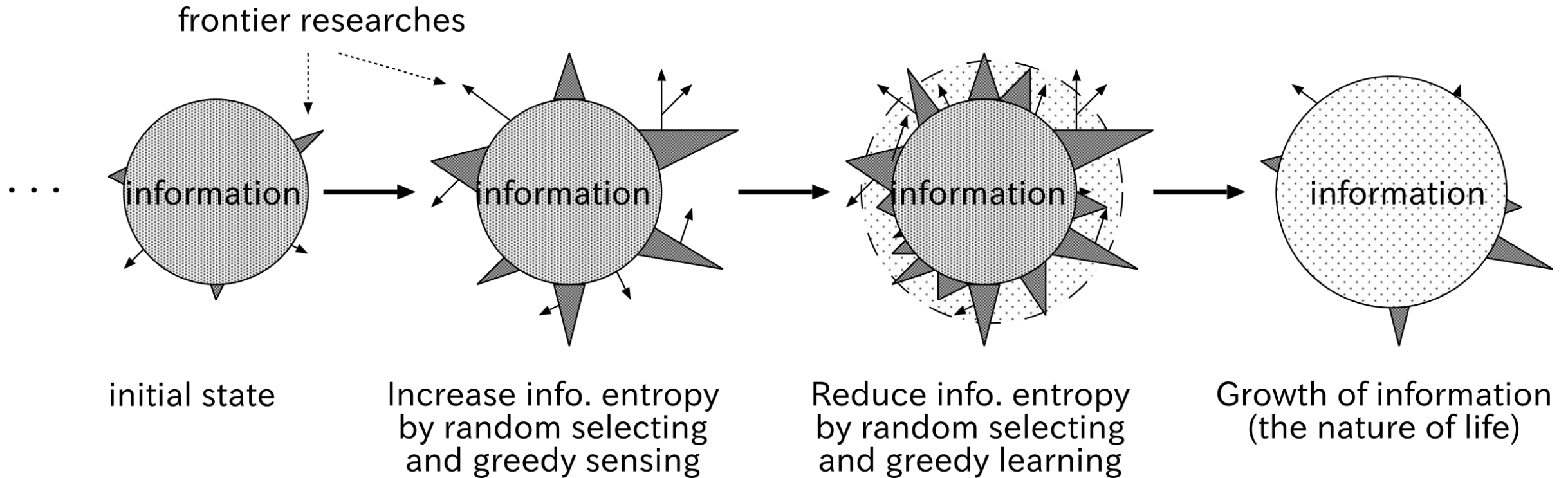
Finding something new is not interesting. Growing the information is.

Can AI be wise

- I believe "yes" if AI has powerful learning ability and enough freedom to do random selections.

趙亮，情報乱雑さで生きることを考えてみる―機械は賢くなれるか，池田裕一編著，京都大学学術出版会，2021年.

Mastering the game of Go with deep neural networks and tree search

David Silver ✉, Aja Huang, Chris J. Maddison, Arthur Guez, Laurent Sifre, George van den Driessche, Julian Schrittwieser, Ioannis Antonoglou, Veda Panneershelvam, Marc Lanctot, Sander Dieleman, Dominik Grewe, John Nham, Nal Kalchbrenner, Ilya Sutskever, Timothy Lillicrap, Madeleine Leach, Koray Kavukcuoglu, Thore Graepel & Demis Hassabis ✉

Abstract

The game of Go has long been viewed as the most challenging of classic games for artificial intelligence owing to its enormous search space and the difficulty of evaluating board positions and moves. Here we introduce a new approach to computer Go that uses 'value networks' to evaluate board positions and 'policy networks' to select moves. These deep neural networks are trained by a novel combination of supervised learning from human expert games, and reinforcement learning from games of self-play. Without any lookahead search, the neural networks play Go at the level of state-of-the-art Monte Carlo tree search programs that simulate thousands of random games of self-play. We also introduce a new search algorithm that combines Monte Carlo simulation with value and policy networks. Using this search algorithm, our program AlphaGo achieved a 99.8% winning rate against other Go programs, and defeated the human European Go champion by 5 games to 0. This is the first time that a computer program has defeated a human professional player in the full-sized game of Go, a feat previously thought to be at least a decade away.

Tomorrow's AI - Musk v Altman & OpenAI

Reading https://www.courthousenews.com/wp-content/uploads/2024/02/musk-v-altman-openai-complaint-sf.pdf (Accessed: April 21, 2024).

1. Commercial product: Microsoft, Altman and OpenAI focus the commercial value of AI and AGI (Artificial General Intelligence), showing little concern on its possible danger.

2. Great mission: Larry Page of Google understands the danger of AI/AGI to human but believes developing intelligence higher than human is his mission.

3. AI for humans: Hawking, Musk, and others. Musk sued Altman and OpenAI for they broke the original promise that OpenAI shall benefit all humans by open-source AI/AGI, protecting the human society from domination by the commercial company (i.e., Google).

情報智慧論（後期、科目名「知恵すること－情報の視点から生命と社会の本質を考える」）

- Sorry, Japanese only. 情報や理系の知識がなくても履修できる．

- 生命の本質について，シュレディンガー（1933年ノーベル物理学賞）を初め，物理学者や情報科学者，脳科学研究者らは，エントロピーの概念を用いて考察してきた．これらの考察から，「自然は乱雑になっていき，生命は秩序を求めていく」ことが示唆される。

- 上記理論に対して，生物学や物理学，人類学，脳科学，認知科学，人工知能などの最新成果を踏まえて詳しく考察する．時事分析を用いながら，環境問題や学問の変遷，ホモ・サピエンスの生存，人類社会の発展，イノベーション，人工知能，未来の生命などを考える．

- 受講生の声：非常に京大らしく大学院で行う意義のある授業だと感じた．授業も少人数でディスカッションが行いやすく，それぞれバックグラウンドの異なる学生が参加していたため，非常に学際的で実のある話ができたと感じた．＊より学生がこの授業の価値を感じて受講を進める場合には，もう少し学生の引っ掛かりやすいタイトルがいいのではとおもいました．それぐらい素晴らしく重要な講義でした．

A case study

(a) Alignment   (b) Cohesion   (c) Separation
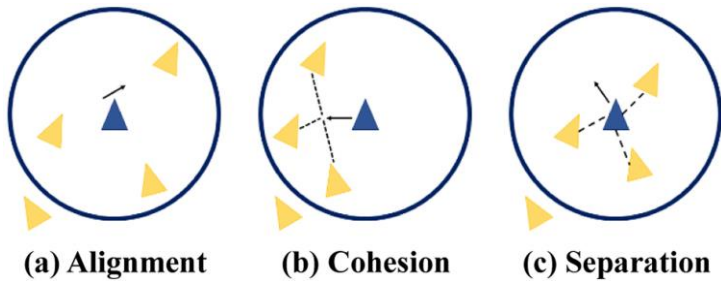
Self-organization with small data

- Boids (Reynolds'86): Alignment, Cohesion, Separation
- 日本人の団結力（羽田正）：ルールを守る、KY、人に迷惑をかけない
- Shared Leadership's 3C model (Xu & Zhao 2022): Collective achievement, Cohesive support, Complementary expertise