AI Augmentation and Creativity

Amir Saffari, Director of Applied AI

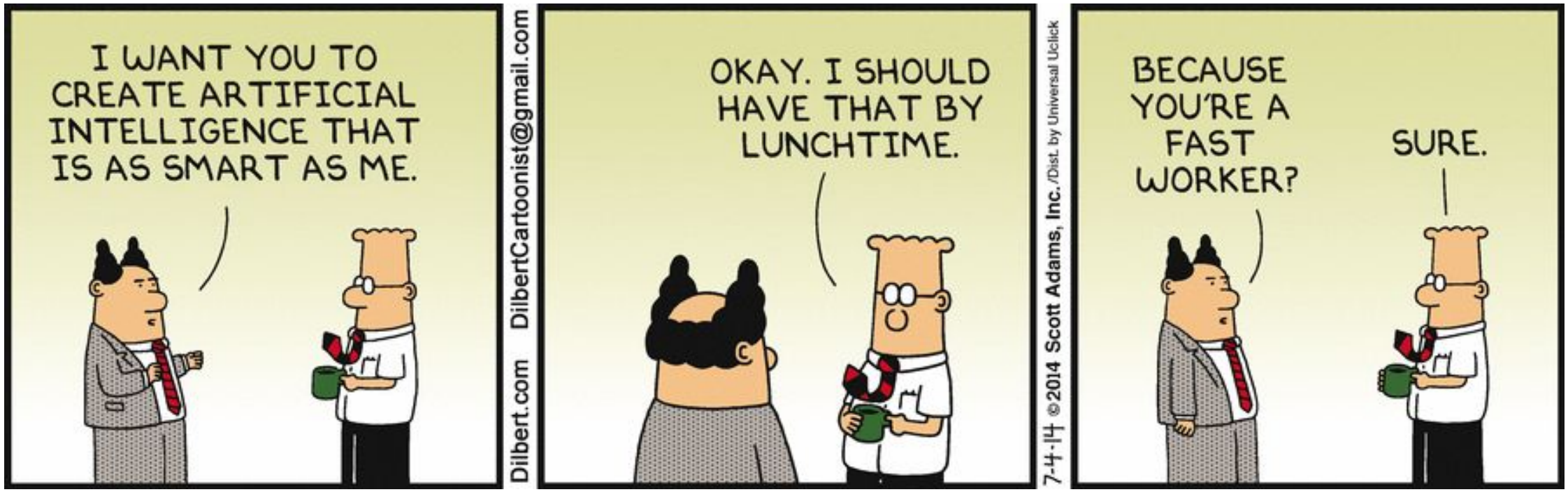
amir.saffariazar@benevolent.ai - @amirsaffari

14th Nov 2017

BenevolentAI

A very brief history of AI

Early on we thought it's very easy (50s and 60s)



http://dilbert.com/strip/2014-07-04

A very brief history of AI

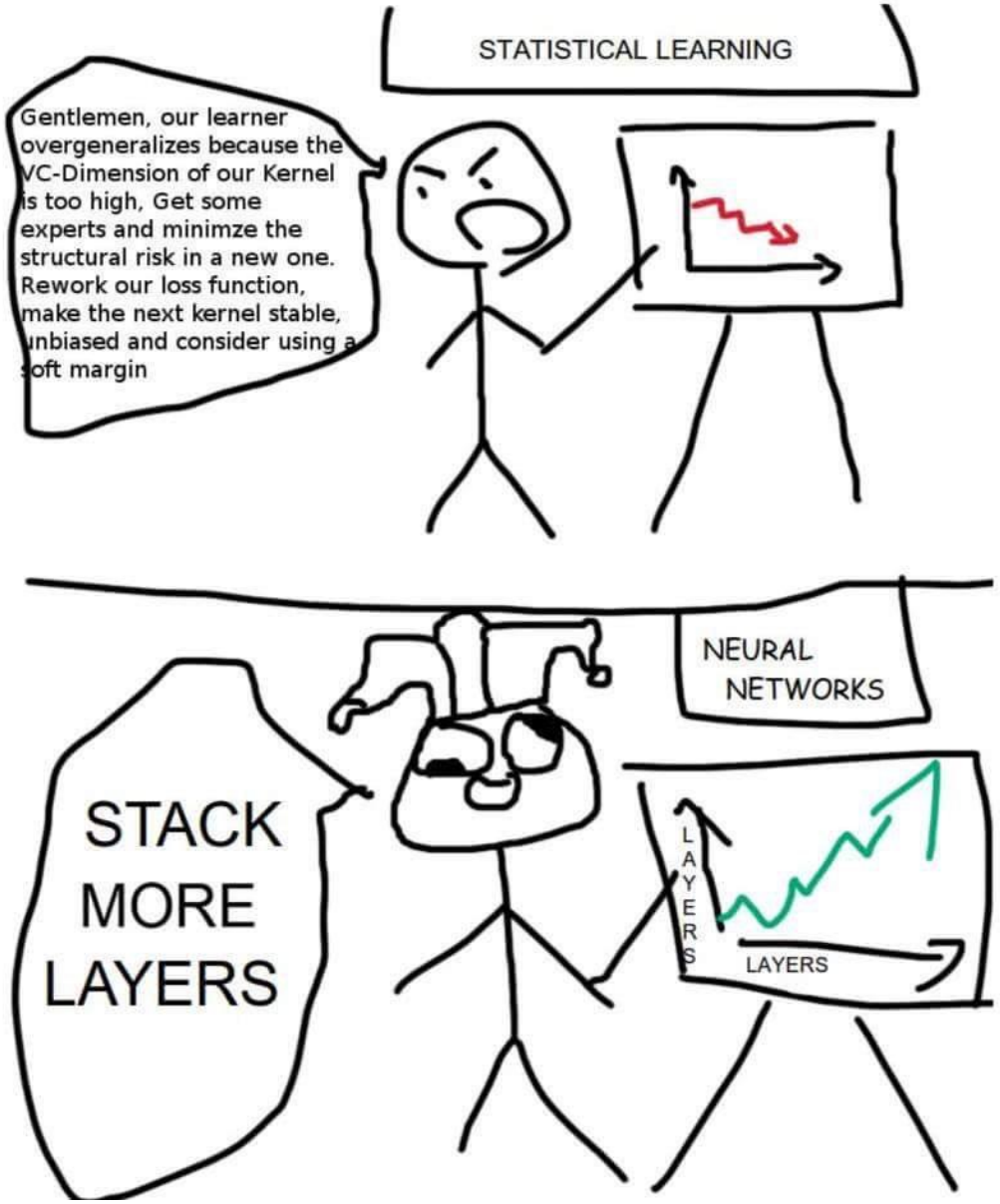
The field suffered two consecutive AI winters (70s and 80s)

https://www.pexels.com/photo/snow-covered-ground-60561/

https://xkcd.com/1838/

A very brief history of AI

We started to take Machine Learning seriously and the Internet helped (90s and 2000s)

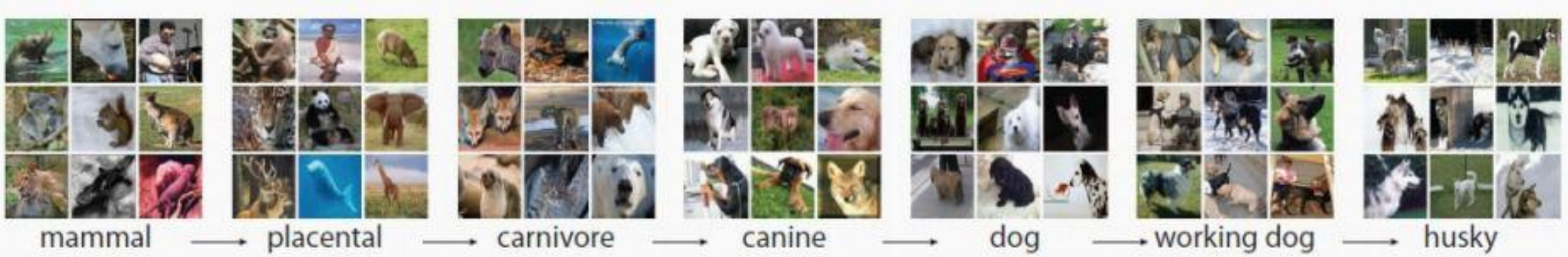


A very brief history of AI

We rediscovered Neural Networks (Deep Learning), found large datasets and GPUs (2010s)

https://livingthing.danmackinlay.name/deep_learning.html

ImageNet: object recognition



- S: (n) Eskimo dog, **husky** (breed of heavy-coated Arctic sled dog)
  - *direct hypernym* / ***inherited hypernym*** / *sister term*
    - S: (n) working dog (any of several breeds of usually large powerful dogs bred to work as draft animals and guard and guide dogs)
      - S: (n) dog, domestic dog, Canis familiaris (a member of the genus Canis (probably descended from the common wolf) that has been domesticated by man since prehistoric times; occurs in many breeds) *"the dog barked all night"*
        - S: (n) canine, canid (any of various fissiped mammals with nonretractile claws and typically long muzzles)
          - S: (n) carnivore (a terrestrial or aquatic flesh-eating mammal) *"terrestrial carnivores have four or five clawed digits on each limb"*
            - S: (n) placental, placental mammal, eutherian, eutherian mammal (mammals having a placenta; all mammals except monotremes and marsupials)
              - S: (n) mammal, mammalian (any warm-blooded vertebrate having the skin more or less covered with hair; young are born alive except for the small subclass of monotremes and nourished with milk)
                - S: (n) vertebrate, craniate (animals having a bony or cartilaginous skeleton with a segmented spinal column and a large brain enclosed in a skull or cranium)
                  - S: (n) chordate (any animal of the phylum Chordata having a notochord or spinal column)
                    - S: (n) animal, animate being, beast, brute, creature, fauna (a living organism characterized by voluntary movement)
                      - S: (n) organism, being (a living thing that has (or can develop) the ability to act or function independently)
                        - S: (n) living thing, animate thing (a living (or once living) entity)
                          - S: (n) whole, unit (an assemblage of parts that is regarded as a single entity) *"how big is that part compared to the whole?"; "the team is a unit"*
                            - S: (n) object, physical object (a tangible and visible entity; an entity that can cast a shadow) *"it was full of rackets, balls and other objects"*
                              - S: (n) physical entity (an entity that has physical existence)
                                - S: (n) entity (that which is perceived or known or inferred to have its own distinct existence (living or nonliving))

https://qz.com/1034972/the-data-that-changed-the-direction-of-ai-research-and-possibly-the-world/

ImageNet: object recognition

2010: Hand-engineered representations + ML
~ 25% error rate

http://karpathy.github.io/2014/09/02/what-i-learned-from-competing-against-a-convnet-on-imagenet/

ImageNet: object recognition

Humans are very good at this
~ 5% error rate

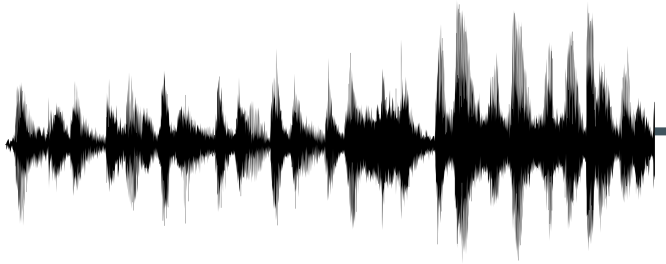
ImageNet: object recognition

Humans are very good at this
~ 5% error rate

2017: Very Deep Neural Nets
~ 2.5% error rate

Advances in computer vision enabling self-driving cars

https://electrek.co/2016/10/10/tesla-vision-autopilot-autonomous-driving-nvidia-cuda/
https://medium.com/@ricardo.zuccolo/self-driving-cars-opencv-and-svm-machine-learning-with-scikit-learn-for-vehicle-detection-on-the-bf88860e055a



Book me a hotel for tomorrow!

Diverse applications

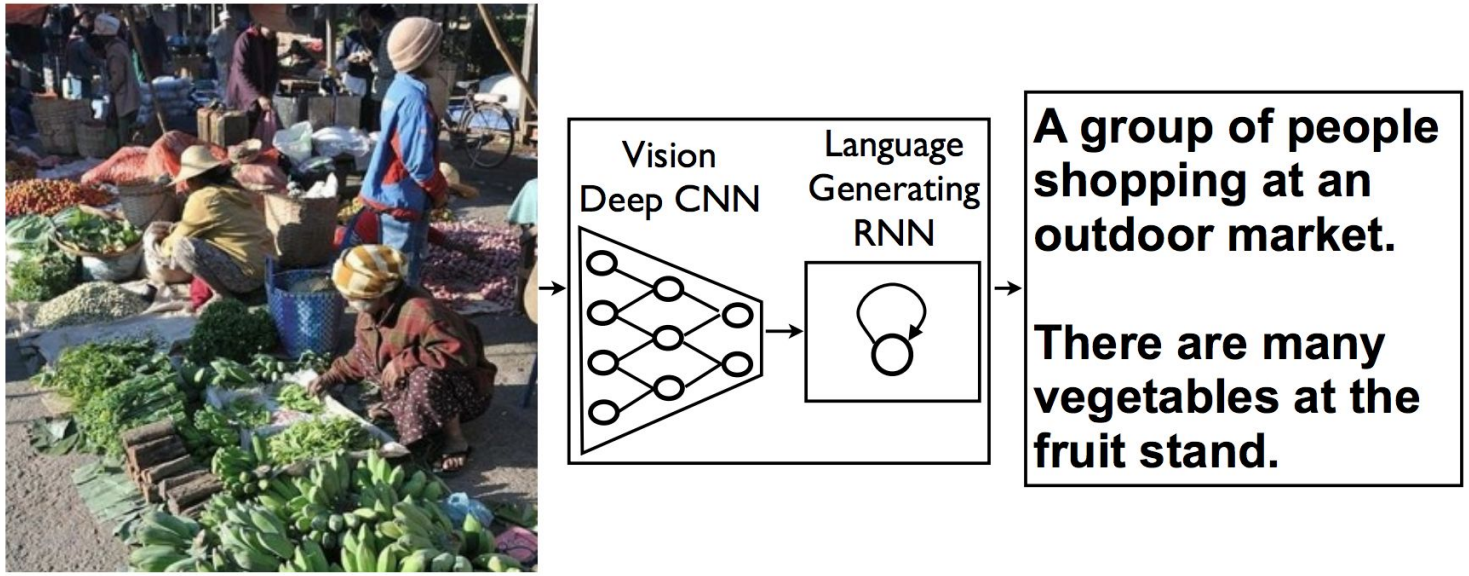
In meteorology, precipitation is any product of the condensation of atmospheric water vapor that falls under **gravity**. The main forms of precipitation include drizzle, rain, sleet, snow, **graupel** and hail... Precipitation forms as smaller droplets coalesce via collision with other rain drops or ice crystals **within a cloud**. Short, intense periods of rain in scattered locations are called "showers".

What causes precipitation to fall?
gravity

What is another main form of precipitation besides drizzle, rain, snow, sleet and hail?
graupel

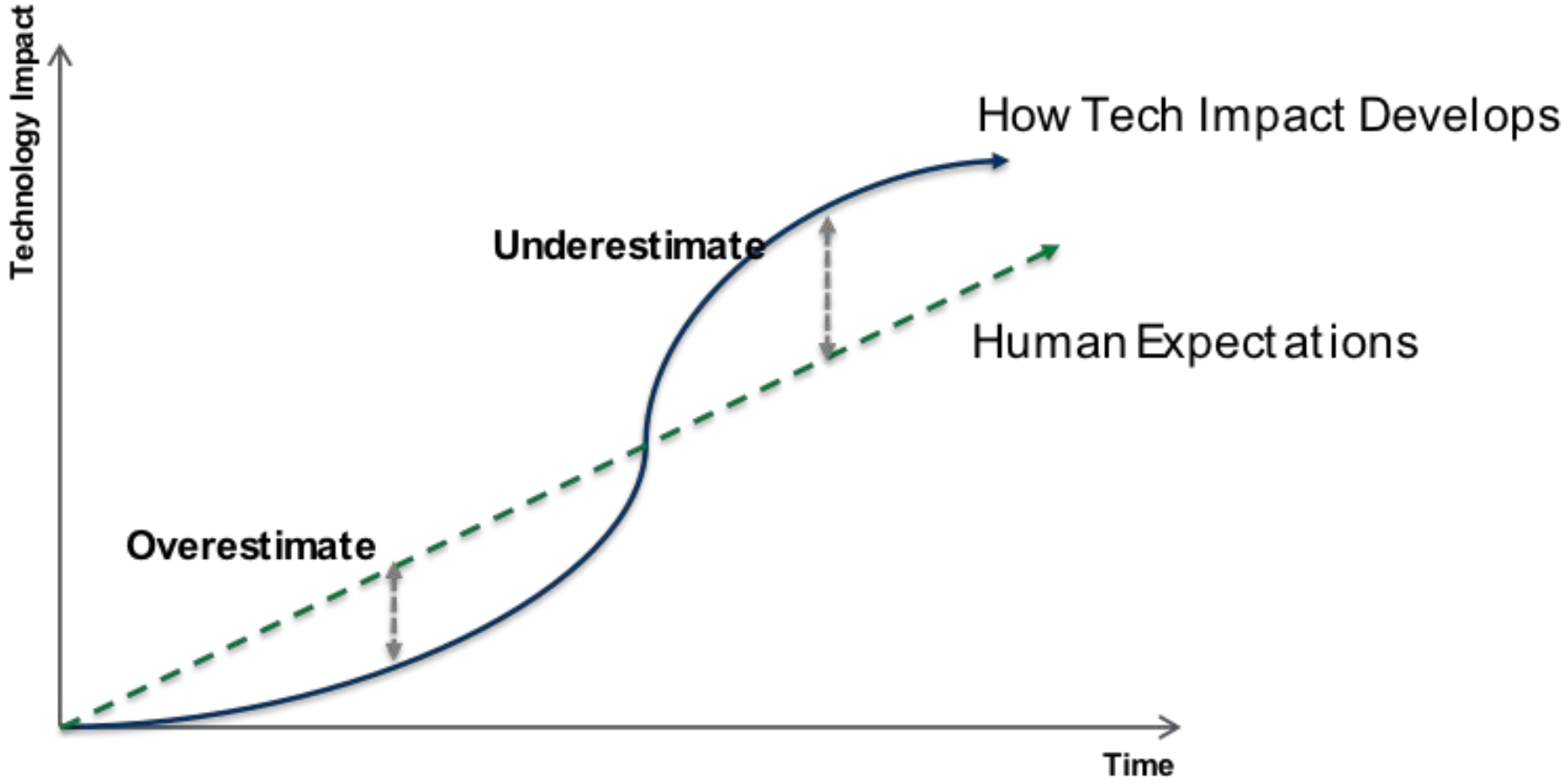
Where do water droplets collide with ice crystals to form precipitation?
within a cloud

Book me a hotel for tomorrow! → Bucht mir ein Hotel für morgen

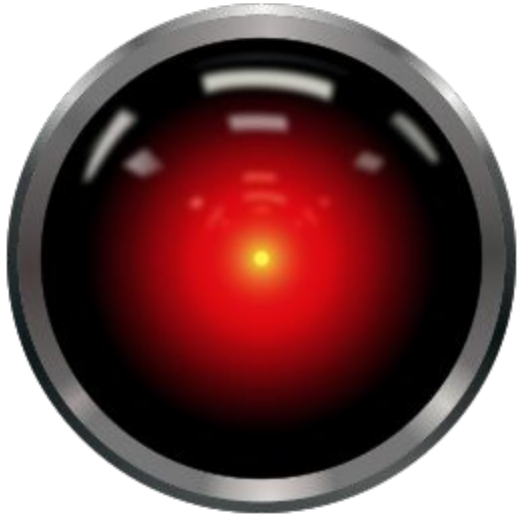


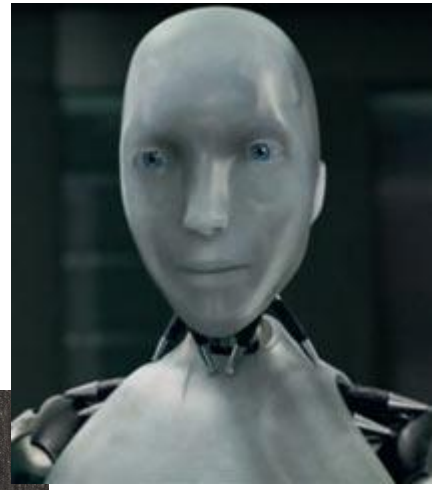
https://openclipart.org/detail/260959/sound-wave https://arxiv.org/abs/1609.06647 https://arxiv.org/abs/1606.05250

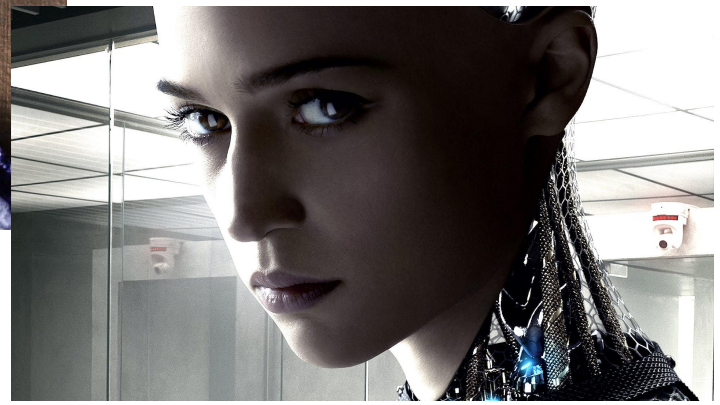
AI hype



https://www.cbinsights.com/research/ai-vs-intelligence-augmentation-applications/







Stereotypification of AI

Our mental image of AI is very much influenced by science fiction

Anthropomorphisation of AI, fuzzy language, and, bad tech journalism

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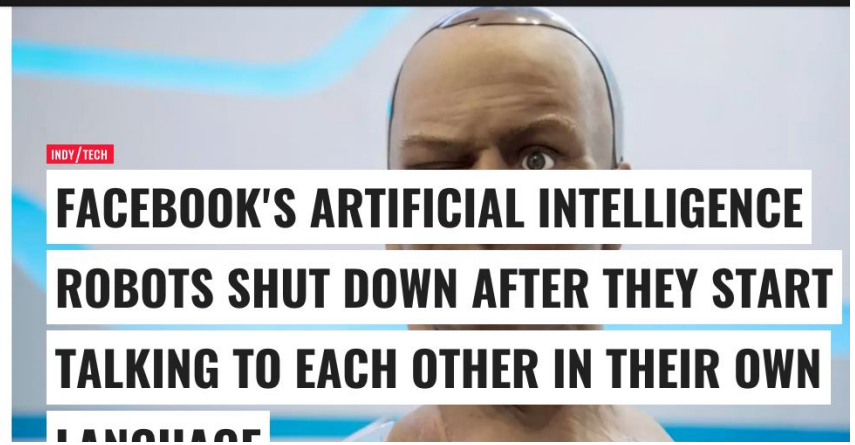

INDY/TECH

FACEBOOK'S ARTIFICIAL INTELLIGENCE ROBOTS SHUT DOWN AFTER THEY START TALKING TO EACH OTHER IN THEIR OWN

The Telegraph HOME | NEWS | SI

Technology

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› Technology

Facebook shuts down robots after they invent their own language

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Code

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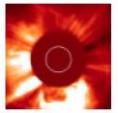
14 June ARTIFICIAL INTELLIGENCE · RESEARCH

Deal or no deal? Training AI bots to negotiate

WIRED Technology | Science | Culture | Video | Reviews | Magazine



In 1770, a huge solar storm turned the skies of Asia red for two weeks

—

3 hours ago

Tuesday briefing: May attacks Putin over online propaganda

—

3 hours ago

The Punisher is everything that's wrong with American masculinity

—

1 day ago

Facebook

Facebook teaches bots how to negotiate. They learn to lie instead

The chatbots came up with their own original and effective responses - including deceptive tactics

Key misconceptions

AI is about to take over the world

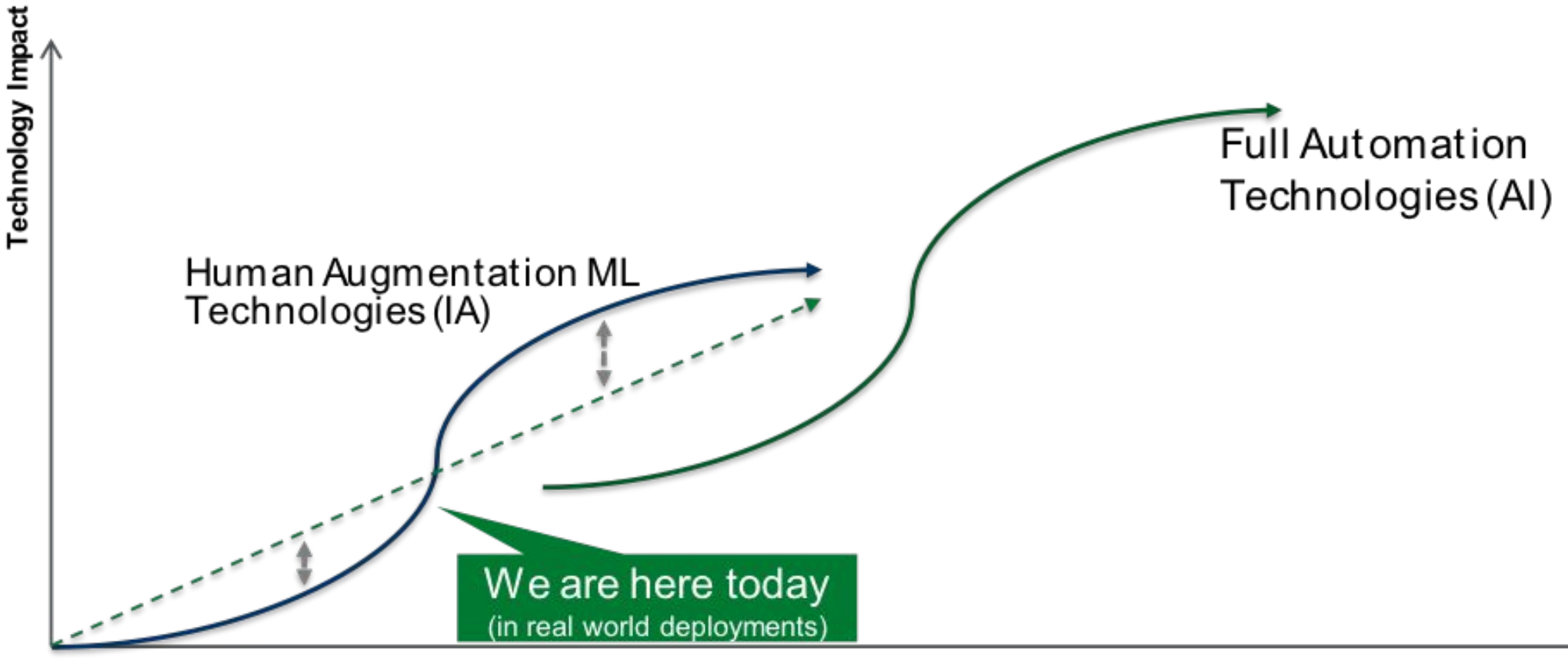
AI is all hype

Progress in AI and automation

Many of us translate advances in AI to automation, replacing humans with machines, job losses, ...

AI Augmentation

AI augmentation



https://www.cbinsights.com/research/ai-vs-intelligence-augmentation-applications/

BenevolentAI: AI-accelerated scientific discovery

1 scientific paper is published every 30 seconds

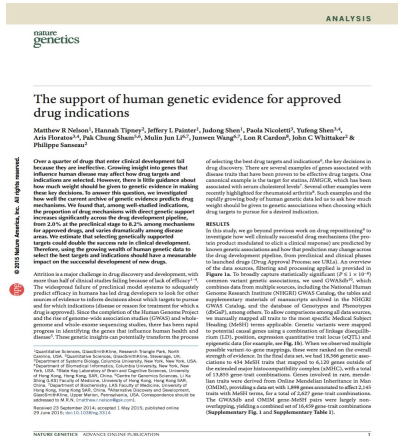
BenevolentAI: AI-accelerated scientific discovery

1 scientific paper is published every 30 seconds

Individual scientists access a tiny fraction of available data in their lifetime - much less than the data generated in 1 day

AI-Driven knowledge and inference models

Unstructured Data



ANALYSIS

nature genetics

The support of human genetic evidence for approved drug indications

Matthew R Nelson[1], Hannah Tipney[2], Jeffery L Painter[1], Judong Shen[1], Paola Nicoletti[3], Yufeng Shen[3,4], Aris Floratos[4,5], Pak Chung Sham[2,6], Mulin Jun Li[6,7], Junwen Wang[6,7], Lon R Cardon[8], John C Whittaker[2] & Philippe Sanseau[1]

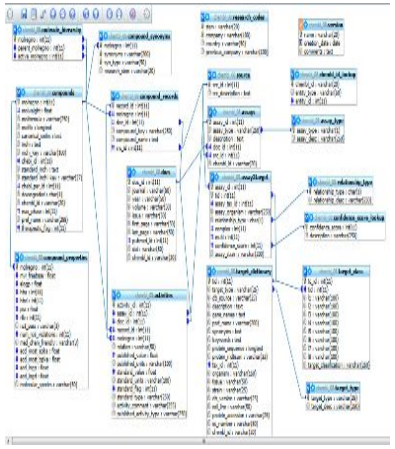
Over a quarter of drugs that enter clinical development fail because they are ineffective. Growing insight into genes that influence human disease may affect how drug targets and indications are selected. However, there is little guidance about how much weight should be given to genetic evidence in making these key decisions. To answer this question, we investigated the extent to which human genetic evidence supports drug mechanisms. We found that, among well-studied indications, the proportion of drug mechanisms with direct genetic support increases significantly across the drug development pipeline, from 2.0% at the preclinical stage to 8.2% among mechanisms for approved drugs, and varies dramatically among disease areas. We estimate that selecting genetically supported targets could double the success rate in clinical development. Therefore, using the growing wealth of human genetic data to inform the choice of drug mechanisms has the potential to have a measurable impact on the successful development of new drugs.

Attrition is a major challenge in drug discovery and development, with more than half of clinical studies failing because of lack of efficacy[1–3]. The widespread failure of preclinical model systems to adequately predict efficacy in humans has led drug developers to look for other sources of evidence to inform decisions about which targets to pursue and for which indications (disease or reason for treatment for which a drug is given). Advances in molecular biology, including genome sequencing and the rise of genome-wide association studies (GWAS) and whole-genome and whole-exome sequencing studies, there has been rapid progress in identifying the genes that influence human health and disease[4]. These genetic insights can potentially transform the process of selecting the best drug targets and indications[5], the key decisions in drug discovery. There are several examples of genes associated with disease traits that have been proven to be effective drug targets. One canonical example is the target for statins, *HMGCR*, which has been associated with serum cholesterol levels[6]. Several other examples were recently highlighted for rheumatoid arthritis[5]. Such examples and the wealth of human genetic data motivate us to ask how much weight should be given to genetic associations when choosing which drug targets to pursue for a desired indication.

RESULTS

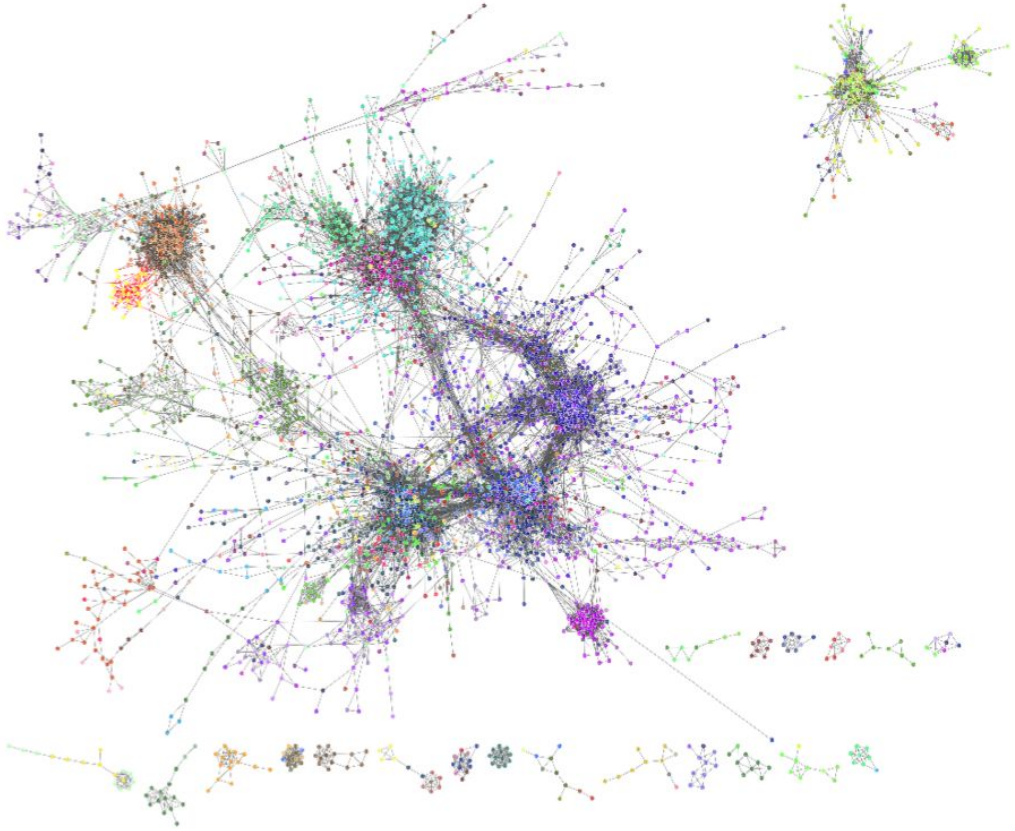
In this study, we go beyond previous work on drug repositioning[6] to investigate how well clinically successful drug mechanisms (the protein product modulated to elicit a clinical response) are predicted by known genetic associations and how that prediction may change across the drug development pipeline. We assembled a comprehensive set of launched drugs (Drug Approval Process see URLs). An overview of the data sources, filtering and processing applied is provided in **Figure 1a**. To broadly capture statistically significant ($P \leq 5 \times 10^{-8}$) common variant genetic associations, we used GWASdb v2[7], which combines data from multiple sources, including the National Human Genome Research Institute (NHGRI) GWAS Catalog, the tables and supplementary materials of manuscripts archived in the NHGRI GWAS Catalog, and the database of Genotypes and Phenotypes (dbGaP). To identify the disease indications associated with mechanisms, we manually mapped all traits to the most specific Medical Subject Heading (MeSH) terms applicable. Genetic variants were mapped to potential causal genes using a combination of linkage disequilibrium (LD), position, expression quantitative trait locus (eQTL) and epigenetic data (for example, see Fig. 1b). When we observed multiple possible variant-to-gene mappings, these were ranked on the overall strength of evidence. In the final data set, we had 16,500 genetic associations to 434 MeSH traits that mapped to 6,120 genes outside of the extended major histocompatibility complex (xMHC), with a total of 13,800 unique trait-gene associations (Online Methods). Mendelian traits were derived from Online Mendelian Inheritance in Man (OMIM), providing a data set with 1,898 genes annotated to affect 2,145 traits with MeSH terms, for a total of 2,627 gene-trait combinations. The GWAS*db* and OMIM gene-MeSH pairs were largely non-overlapping, yielding a combined set of 16,459 gene-trait combinations (**Supplementary Fig. 1** and **Supplementary Table 1**).

Structured Data

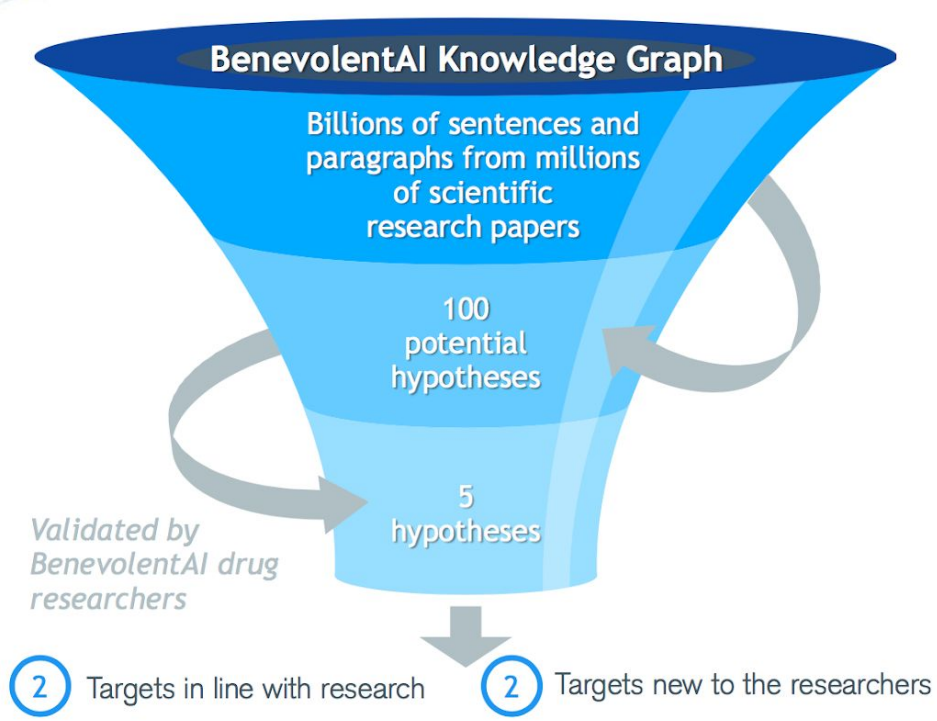


Large Scale NLP, Machine Learning, Deep Learning, and Neural Reasoning Technology

Rich proprietary knowledge



BenevolentAI Finds Potential Treatments for ALS



Validated by SITraN, expert researchers on ALS

"I was impressed by the initial hypotheses that were presented at our first meeting together. One of the ideas was very much a central part of our ongoing research and immediately validated the technology. The second idea was quite a novel one for treatments for ALS. Without the augmentation and insight that the technology allows us, these are possibilities we may have otherwise overlooked."

Dr. Mead, Sheffield Institute of Translational Neuroscience

Medicine and computing

The shoulders of gAInts

The Economist

Artificial intelligence may help unpick the complexity of biology

"BenevolentAI has already validated on pathway for drug discovery and opened up a surprising new one. What their engine can do is look across vast swaths of information to pick novel ideas repurpose…BenevolentAI has given me two ideas for drugs for ALS, one is bang in the middle of what I and my teams are doing already…AI is generating good ideas. The other is complicated and not obvious, but mechanistically interesting."

Dr Richard Mead.. Lecturer in Neuroscience, University of Sheffield

"Benevolent AI is not a one-off. More and more people and firms believe that AI is well placed to help unpick biology and advance human health…It can in weeks elucidate salient links and offer new ideas that would take lifetimes of human endeavor to come up with. I can also weigh up the evidence for its hypotheses in an evenhanded manner."

The Economist

FINANCIAL TIMES

Bold claims for AI are hard to compute for economist

"AI-enabled technologies could double the economic growth rates of many advance countries by 2035"

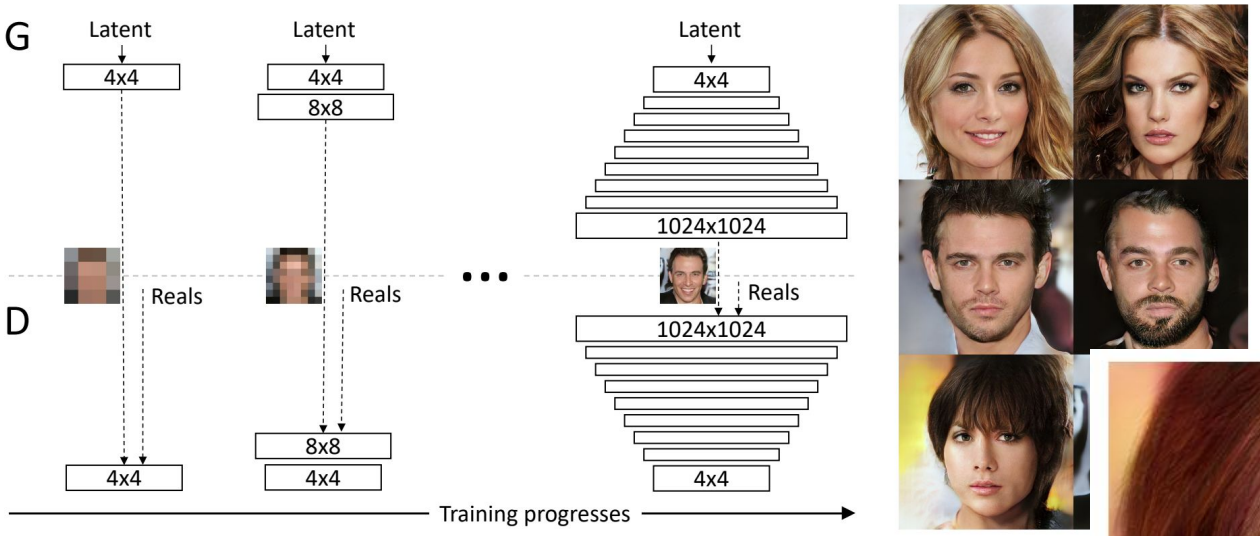
The Financial Times

"It [BenevolentAI] can also personalise solutions for individuals according to their genetic make up, we are really excited about it, the potential is incredible"

Dr Laura Ferraiuolo, PhD. Lecturer in Translational Neurology

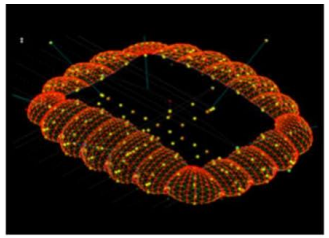
http://research.nvidia.com/sites/default/files/publications/karras2017gan-paper-v2.pdf

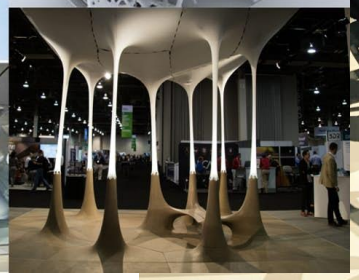
Generative Models

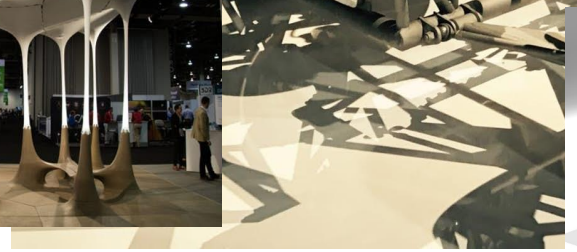


http://research.nvidia.com/sites/default/files/publications/karras2017gan-paper-v2.pdf

Generative Design







https://newatlas.com/autodesk-generative-design-interview/50824/

Music and AI

FEATURED

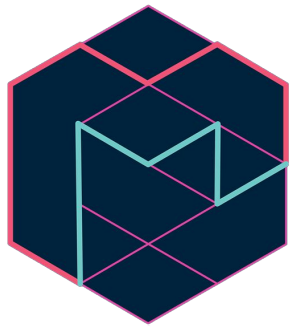
LNH MUSIC

LnH: The Band

Posted on 30/09/2016 by amir / 0 Comment

"LnH: The Band" is an artificial intelligence based musical band. They started originally as a heavy metal band with inspirations from early progressive and power metal bands. Over time they have experimented with other sub-genres of metal and currently have a bit of interest in jazz and blues too.

They are known on Twitter as **@lnh_ai** where you can find their music and request new compositions by twitting nicely at them.



TECH

THIS A.I. CAN WRITE AND TWEET MUSIC ON COMMAND

Genre: Metal, Tempo: 160, Randomness: 0.5. Fun levels? High.

Jukedeck

WIRED Tech Business

/TECH

Diese Roboter-Band twittert Songs nach M

Cindy Michel

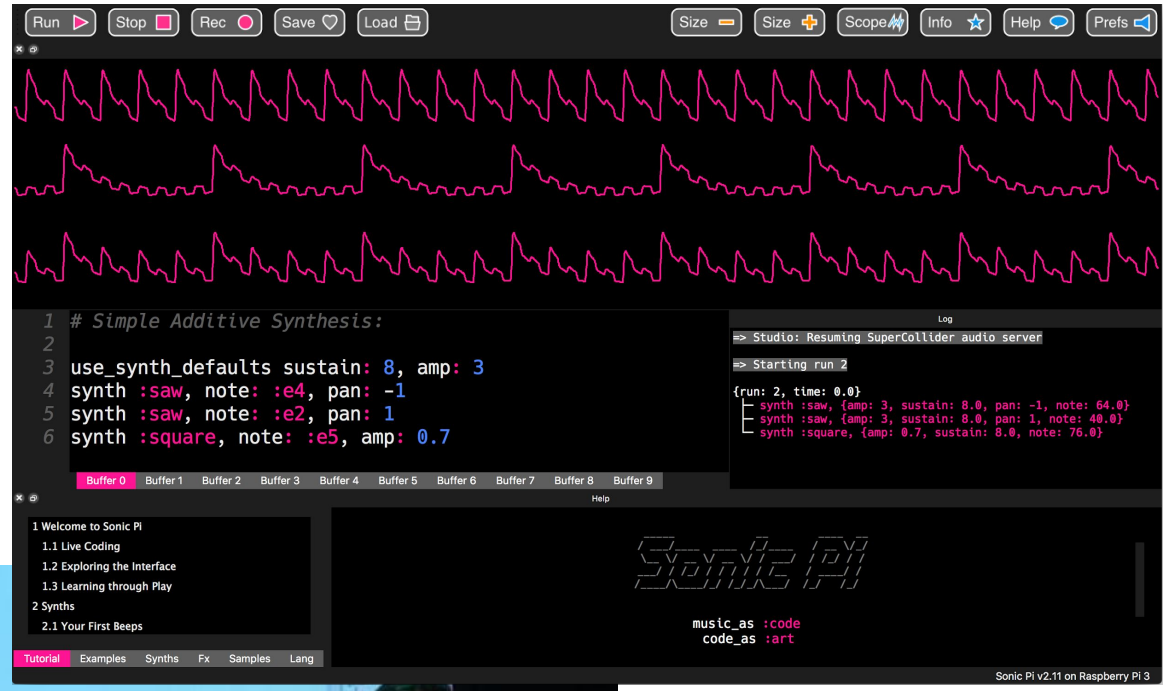
12.10.2016

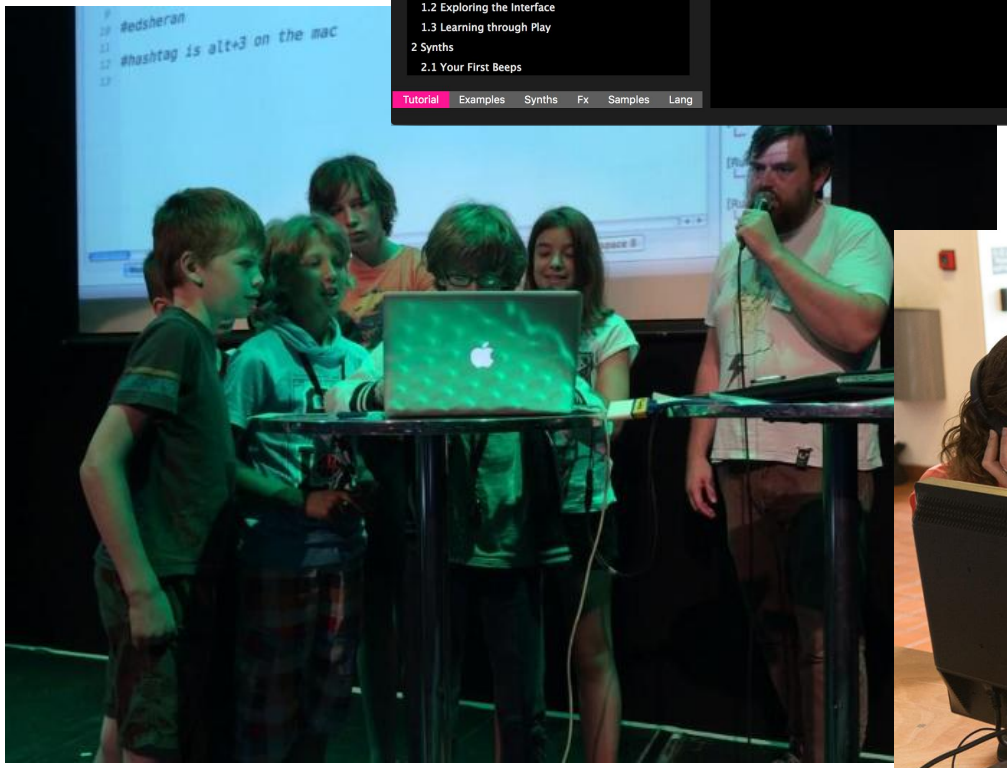
The Musical Twitter Bot: Who Has the Copyright for AI-Facilitated Works?

Blog Social Media & Games Law Blog

Pillsbury Winthrop Shaw Pittman LLP

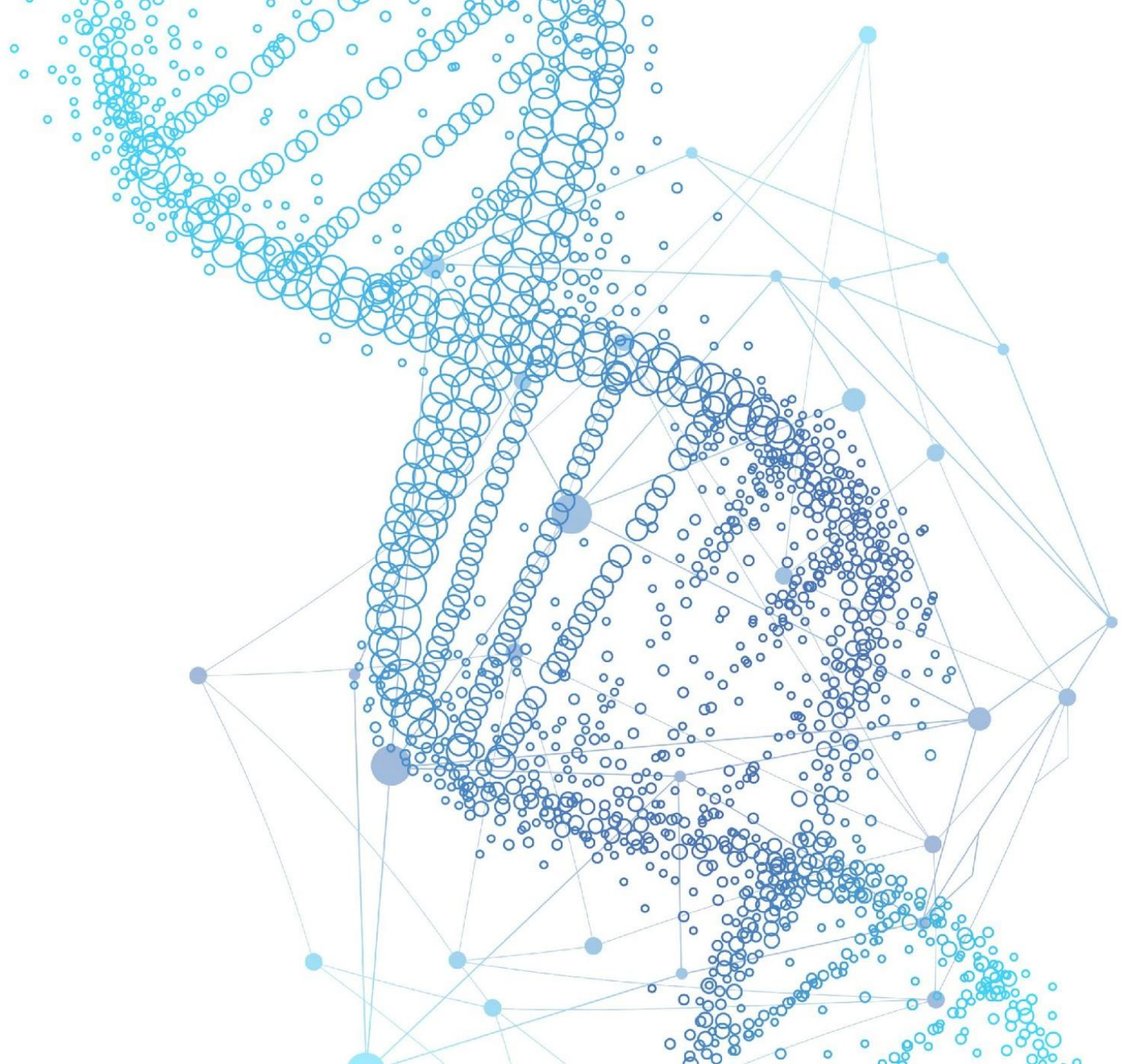
AI and Education





Personalised and interactive education that is fun!

Sonic Pi

Human augmentation through AI

scientific discovery, healthcare, education, ...