



University of
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Artificial Intelligence as a 'Medium'

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Motivation

I began working AI in the mid-1980s, working from 1985-88 at ECRC (European Computer-Industry Research Centre).

This was a European response to the Japanese 5th Generation Project in AI.

As was the Alvey Programme in the UK, and Microelectronics and Computer Technology Corporation in the US.



ECRC: Arabellaplatz, Munich

Sound familiar?

Motivation

But the AI winter struck. So moved into astrophysics for some 20 years

Now looking at AI again as much has happened in the last decade, and returning to some work I did in the 1990s on the nature of AI



Arabellaplatz by Winter

...concerned that the field may repeat some of the same mistakes that led to the Winter

AI as a intelligent other

Most compelling metaphor –
everywhere - especially stock
images for AI/ML

- Appeals to natural psychology
Hyperactive Agent Detection
Device
- We see agency as a just-in-case
(safer to assume possible agent
and only look stupid when not)
- Similar to Pareidolia: e.g.
Heathen Maiden in Julian Alps,
Slovenia



Heider and Simmel Animation

Much as we see faces due to evolutionary advantage, the mind also works to infer social variables - such as causality and animacy - from simpler inputs, such as actions and movements.

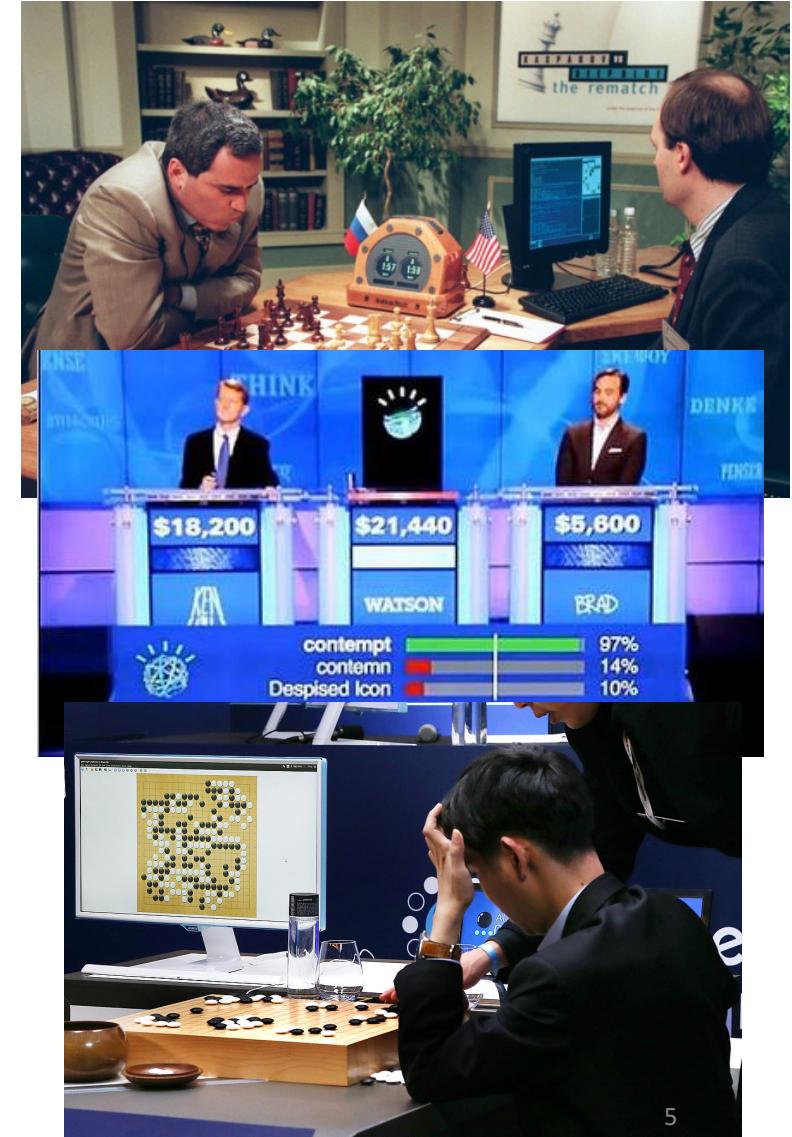
Classic study goes back decades, to 1944

<https://www.youtube.com/watch?v=XtXTumJAniA>

AI as ‘opponent’

- IBM Deep Blue 1997, beat world-class chess champion Gary Kasparov
- IBM Watson 2011, question answering system won Jeopardy game
- DeepMind AlphaGo 2016, beat Lee Sedol, a 9-dan professional Go player

Creates idea of AI as an opponent to humans, a stronger stance, with obvious impacts on public perception



There are other “metaphors”

Mark Stefik (AI Magazine, Volume 7 Issue 1, 1986)

The most widely understood goal of artificial intelligence is to understand and build intelligent, thinking machines. A perhaps larger opportunity is to understand and build an interactive knowledge medium

We can look to existing media for principles to understand AI, and to aid our designs and deployment

Writing captures thought

One of the oldest media is the written word. Writing has to work across time and space – to be understood at another time in a different place.

Imagine me insisting - in no uncertain terms - that my two young boys:

stop kicking that around the living room

An orator can simply use the tone of voice to convey this. To allow writing to do the same required the invention of new forms, to write :

He insisted that the boys stop kicking that around the living room

Writing captures thought

New verbs, representing speech acts and mental states, were increasingly employed over time as the written form took over from the oral.

Old English used a limited palette of speech act verbs:

believe, know, mean, say, tell, think, understand

Later, in the 15th to 17th centuries, terms such as:

assume, contradict, criticise, explain, infer, suggest

came to be used.

The history of literacy...is the struggle to recover what was lost in simple transcription

Olson (1996)

Writing captures thought

So writing is not just about writing down the words spoken, but encoding what was not actually spoken but present in the verbal moment.

This was required as the author cannot be consulted as to how the text was to be understood

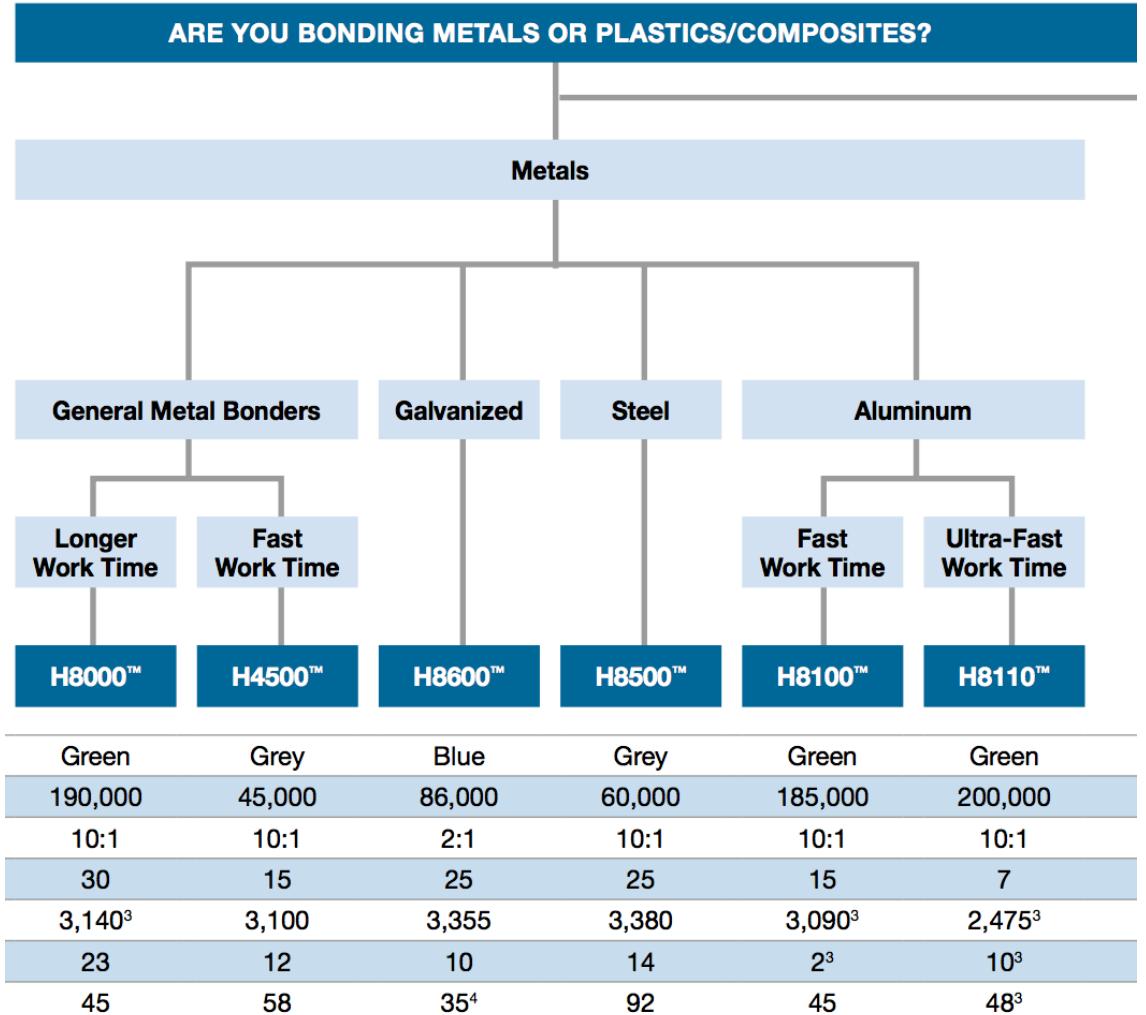
Writing adds an indication of what the author intended – *what they might have said had they been present.*

It can speak more broadly, much as an AI aims to do

Media surfaces

In addition to transcending time and place, media exploit properties of the surface and technologies on which they are written

So paper has a spatial property, unlike speech, which can convey alternatives at the same time

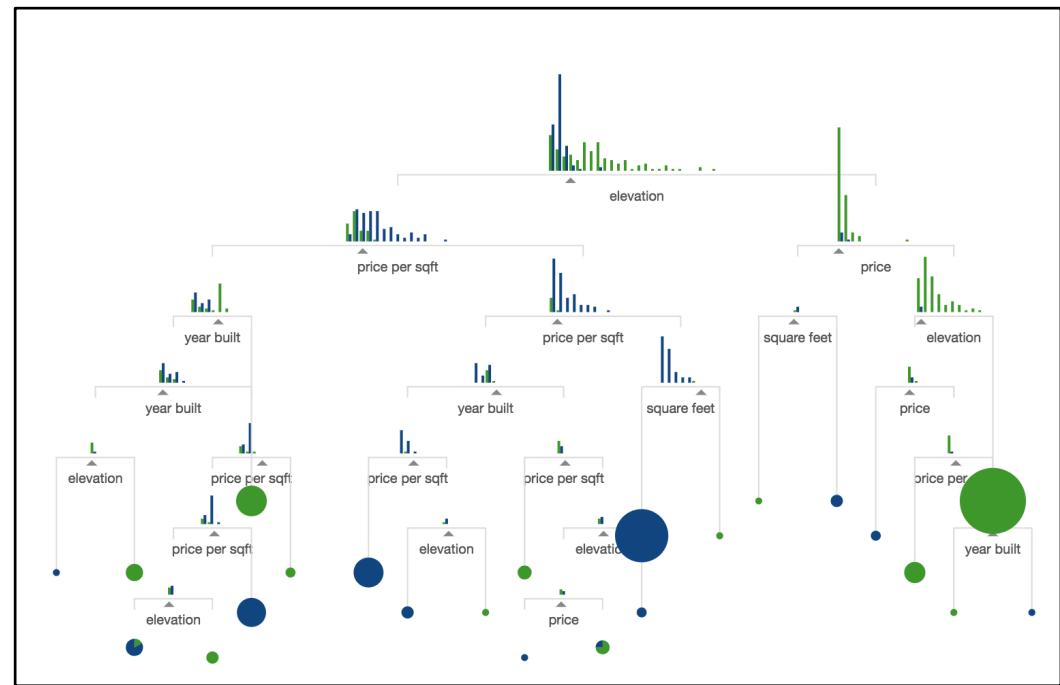


Dynamic surfaces

Computer-based versions of these charts are dynamic, computationally active

A good example can be found at:

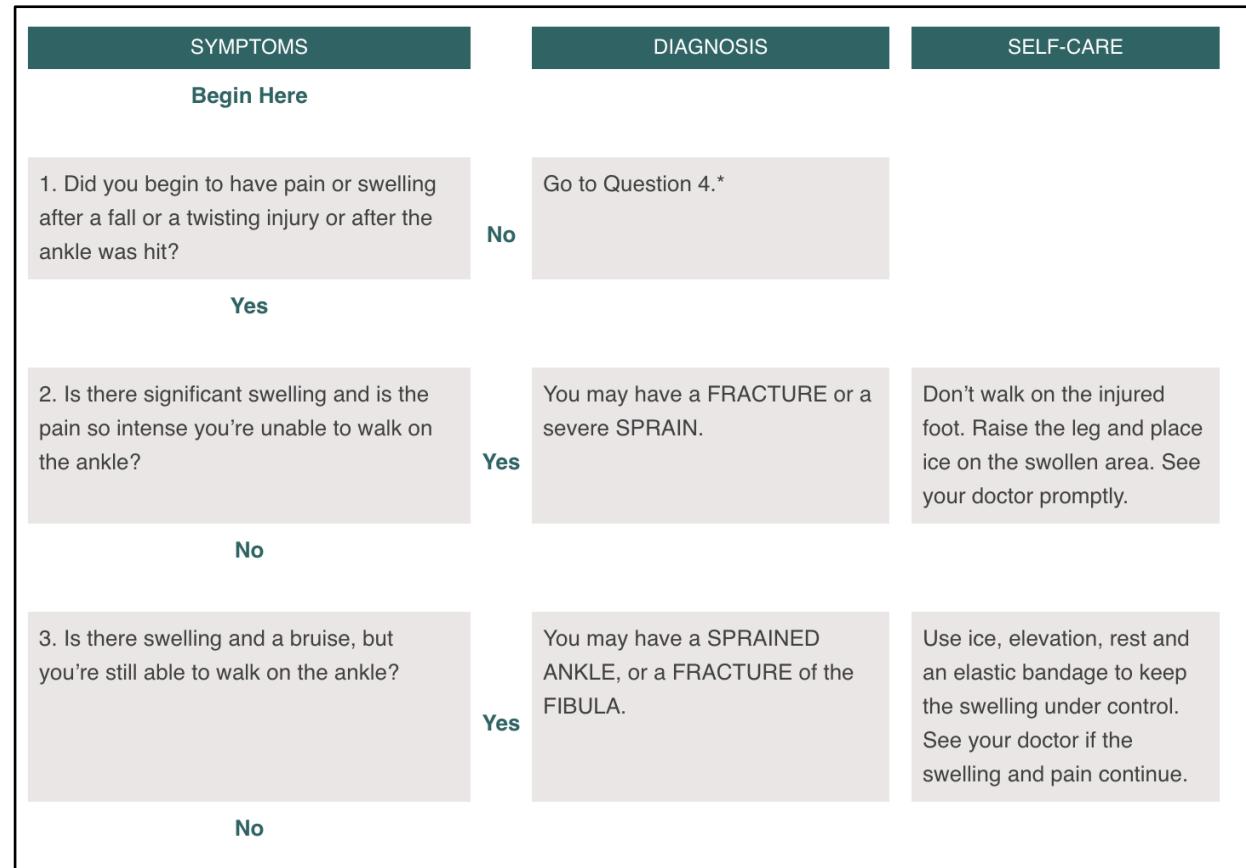
<http://www.r2d3.us/visual-intro-to-machine-learning-part-1/>



Clinical algorithms

Easy to see how this spatial property of written words can relate to symbolic AI (such as found in most chatbots)

Many doctors use clinical algorithms (1). Some are for public use



[excerpt from: Dr. Green Mom Ankle Problems](#)

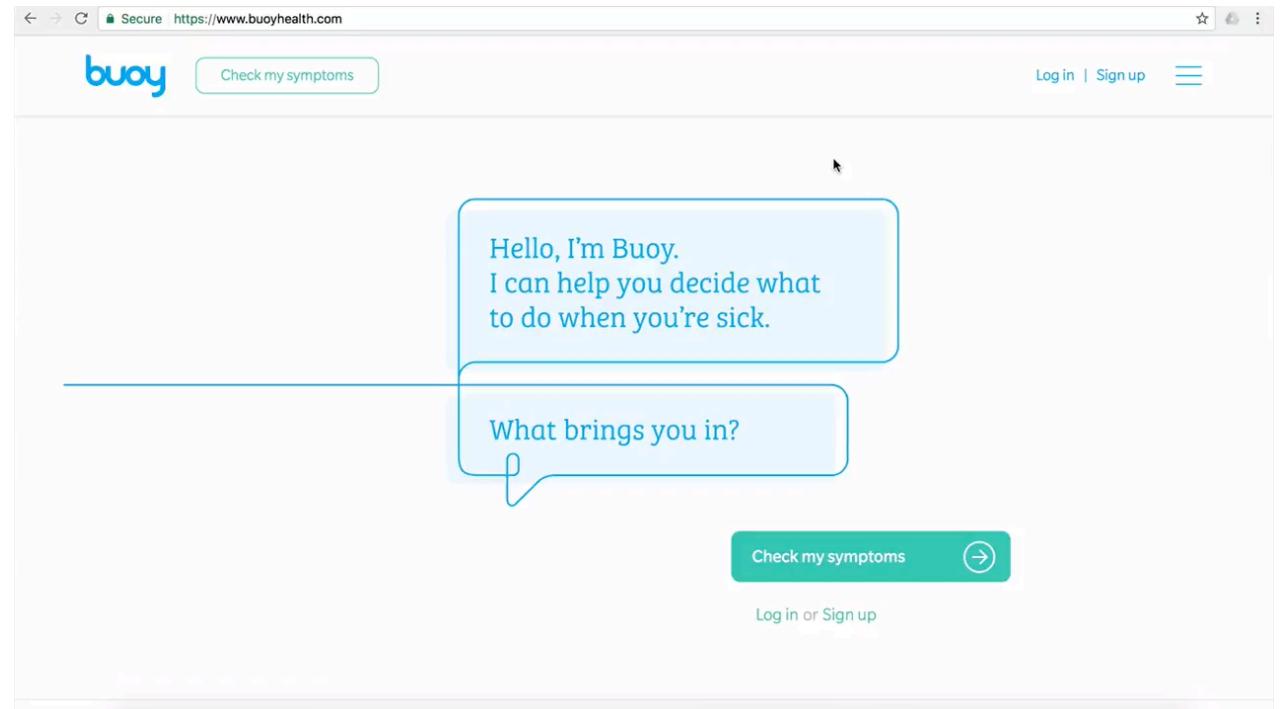
1) <https://www.bmjjournals.org/content/bmjjournals/288/6426/1281.full.pdf>

Clinical chatbot

Buoy (and the similar Babylon Health bot) take the written form from paper surface and place it on a new ‘computational’ surface

Again, it aims to say what the author would have said had they been present

Unlike paper format, hard to see limits of knowledge, and the dialogue triggers agency attribution



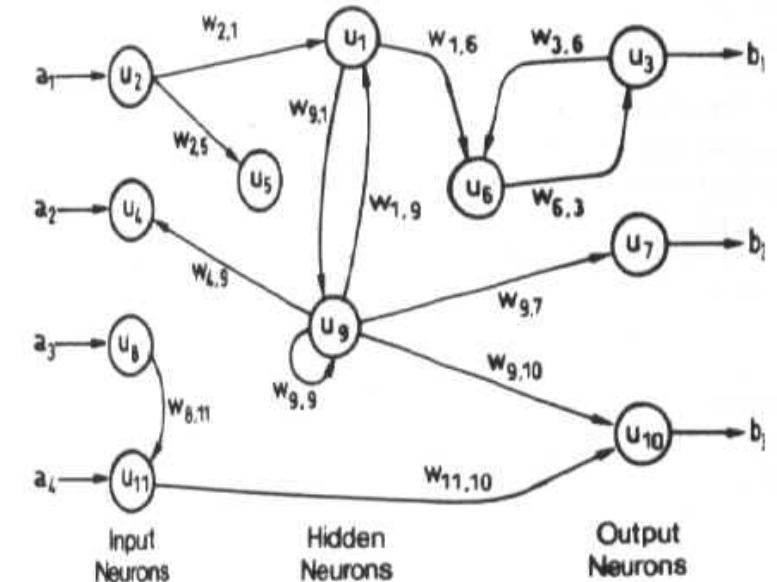
<https://www.buoyhealth.com/symptom-checker/>

ANNs and film/photography

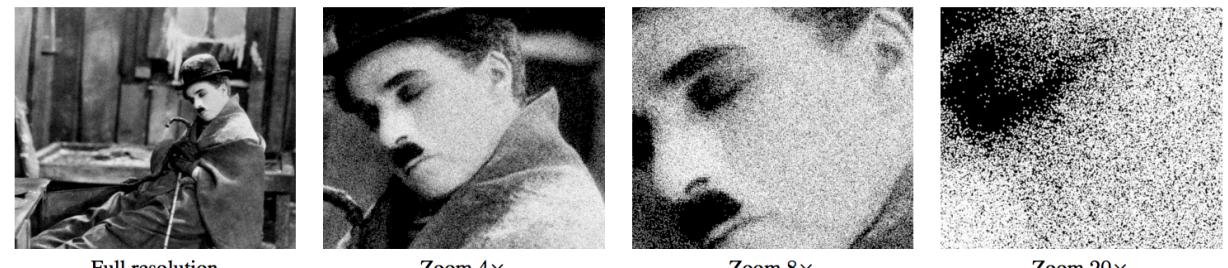
ANNs do not use symbols, as seen in, e.g., chatbots.

Instead, the information is represented in numerical weights

Similarly, in cinema 'what we perceive as an image is in reality a local average density of grains' not things



https://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/cs11/report.html

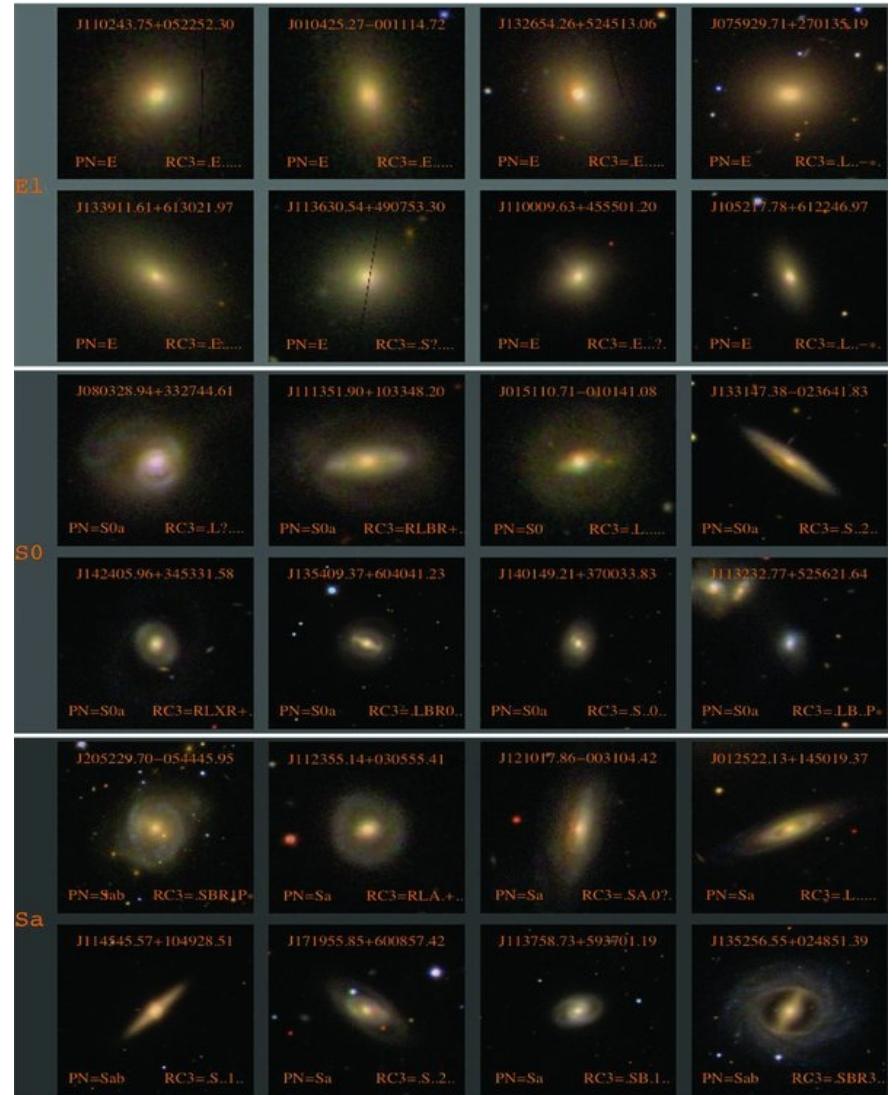


Alasdair Newson, Bruno Galerne, Julie Delon. Stochastic Modeling and Resolution-Free Rendering of Film Grain. MAP5 2016-23. 2016. 14

Machine Learning: CNNs as authored

So does a medium approach work
with images?

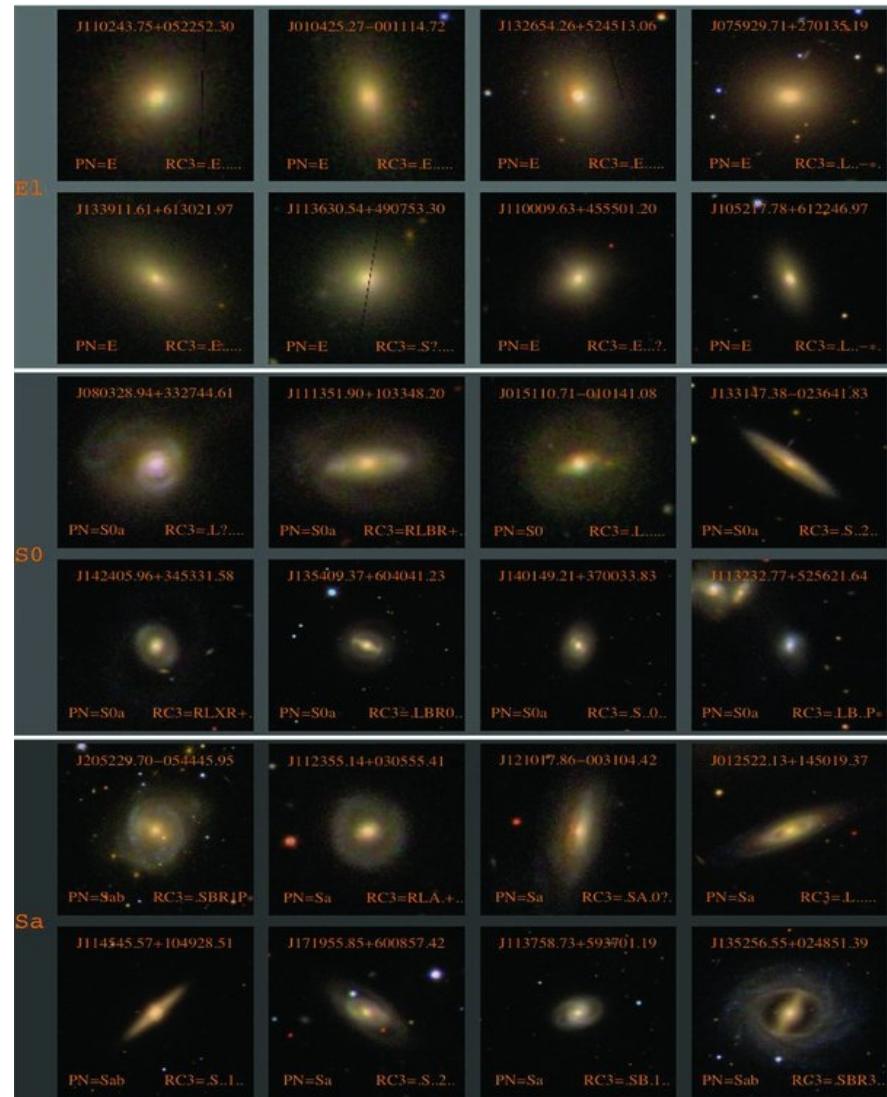
Lets look at use of CNNs in galaxy
classification (recall I worked as a
research astronomer)



Authoring of CNN

Preethi Nair classified, by eye,
~ 14,000 galaxies (twice!)

Creating a large database that
can be used for training a
classifier

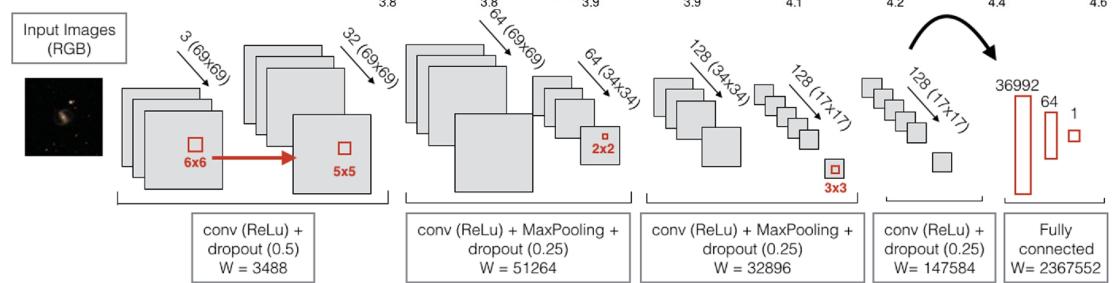
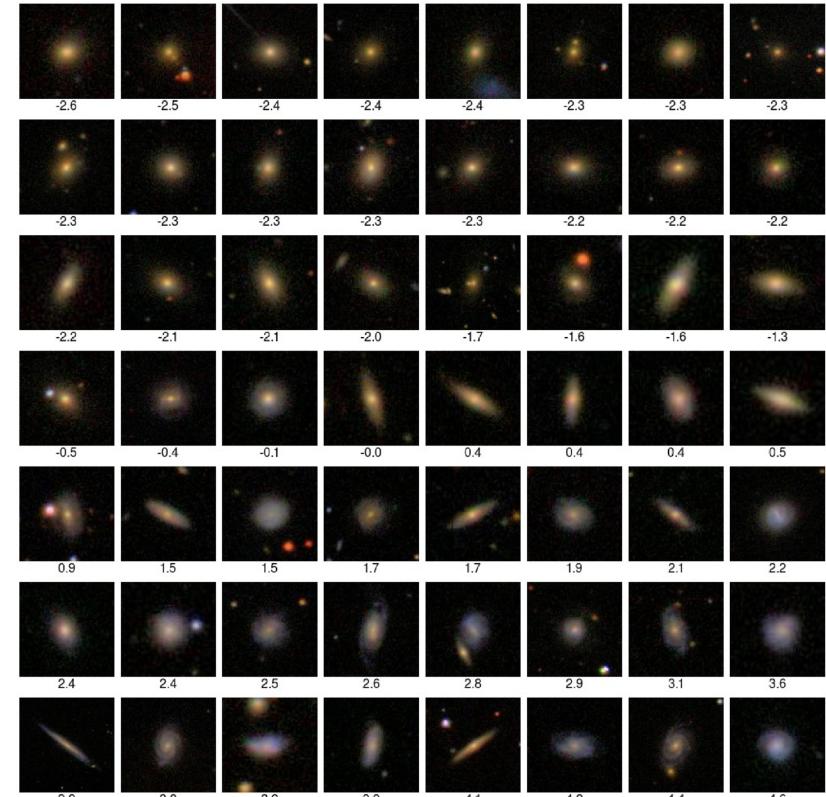


Authoring of CNN

This dataset was used by Domínguez Sánchez et al. (2018) to train a CNN

In one sense the system is a *text* that can say what Nair *might have said if she had been present*

Nair and Domínguez Sánchez are, in a real sense, co-authors of a computational text



Authorship and AI

Such a medium metaphor makes some issues clearer

Bias is a big problem in facial recognition, with studies showing that commercial systems are more accurate if you're white and male. Part of the reason for this is a lack of diversity in the training data, with people of color appearing less frequently than their peers (1)

The ‘writing’ of the text is partly composed of the selection of a training set, and the hyper-parameters

That is, the system is best understood as authored, just as early film excluded people of colour from major roles. Just as a film maker selects the actors, the scenes, etc., to convey a message

1. <https://www.theverge.com/2018/6/27/17509400/facial-recognition-bias-ibm-data-training>

IBM Watson as Cancer Doctor

<https://www.statnews.com/2017/09/05/watson-ibm-cancer/>



IBM Watson (winner of Jeopardy) has been modified for use in cancer diagnosis and treatment

Doctors at Memorial Sloan Kettering acknowledged their influence on Watson. “We are not at all hesitant about inserting our bias, because I think our bias is based on ...having a vast amount of experience,” said Dr. Andrew Seidman.

The system says what the doctors might say when they cannot be there. It is not some autonomous agent, it is a text being ‘read’ at a new time and place

Media Properties

Each media surface and its associated technology have properties that can be used to represent authorial intent

So, cinema has the optical effect of change of focal depth that can be used to change the 'focal point' of the narrative.



Excerpt from *The Host*, South Korea (2006)

https://www.youtube.com/watch?v=FPQ_k80MoE

Media Properties

Occasionally the use of the media generates unplanned, but serendipitous ways of telling a story (circa 1 min in)



The effect was not designed, but when seen by director, left in

In Cold Blood (1967) rain scene

<https://www.youtube.com/watch?v=UjIDrG-MQsc>

Media Properties: Generative Adversarial Networks

Moving from the word ‘zebra’ in text, to the image of a zebra in a photo, to the dynamic model of zebraness in a GAN, used to translate a horse to a ‘zebra’



Jun-Yan Zhu ‘Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks’
<https://arxiv.org/pdf/1703.10593.pdf>

Media Properties: Generative Adversarial Networks

What this GAN developers report as a *Failure Case* can, in the hands of an inventive author/artist be part of a narrative, just as in the rain example above



<https://junyanz.github.io/CycleGAN/>

Media Properties

The written text has a similar serendipity effect, from its spatial nature

This year is the 150 anniversary of the Period Table

		Ti — 50	Zr — 90	? — 180
		V — 51	Nb — 94	Ta — 182
		Cr — 52	Mo — 96	W — 186
		Mn — 55	Rh — 104,4	Pt — 197,4
		Fe — 56	Ru — 104,4	Ir — 198
H = 1		Ni — Co — 59	Pd — 106,6	Os — 199
		Cu — 63,4	Ag — 108	Hg — 200
	Be — 9,4	Mg — 24	Zn — 65,2	Cd — 112
	B — 11	Al — 27,4	? — 68	Ur — 116
	C — 12	Si — 28	? — 70	Sn — 118
	N — 14	P — 31	As — 75	Sb — 122
	O — 16	S — 32	Se — 79,4	Te — 128?
	F — 19	Cl — 35,5	Br — 80	J — 127
	Li — 7 Na — 23	K — 39	Rb — 85,4	Ca — 133
		Ca — 40	Sr — 87,6	Tl — 204
		? — 45	Ce — 92	Pb — 207
		?Er — 56	La — 94	
		?Yt — 60	Di — 95	
		?In — 75,6	Th — 118?	

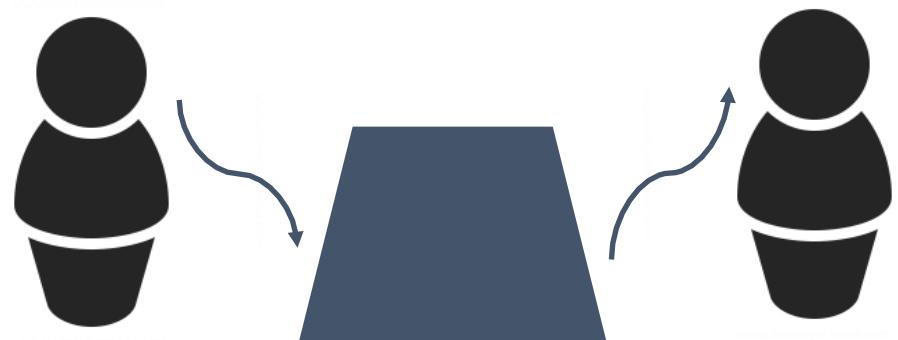
For example, next to Al (aluminium) there's space for an unknown metal. Mendeleev foretold it would have an atomic mass of 68, a density of six grams per cubic centimeter, and a very low melting point. Six years later Paul Émile Lecoq de Boisbaudran, isolated gallium and sure enough it slotted right into the gap with an atomic mass of 69.7, a density of 5.9g/cm³, and a melting point so low that it becomes liquid in your hand.

<https://qz.com/1513175/the-fascinating-design-history-of-the-periodic-table-of-elements/>

Knowledge media: old and new

We can view the new ML technologies, such as CNNs, GANs etc. through the prism of media technologies

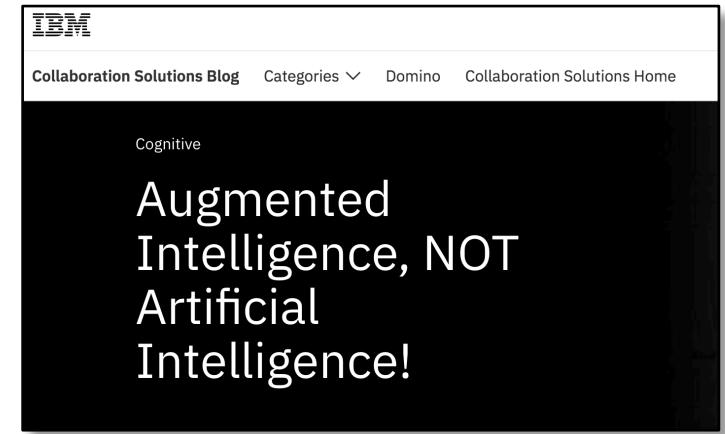
- Writing (old) had a paper surface
- Film (old) had a celluloid surface
- ML has a computational surface



Each surface has its own nature that can be used, by authors, to represent certain ideas. Each medium has its own vocabulary, style, and potential for saying new things

New approaches coming

- IBM ‘artificial intelligence – or augmented intelligence/cognitive as we say at IBM’.
- UoB interactive AI PhDs ‘data-driven and knowledge-intensive human-in-the-loop AI systems’.
- IHMC have developed an alternative view ...’in which the primary technological goal is to amplify, rather than replace, human abilities’.



The image shows a screenshot of an IBM Collaboration Solutions blog post. The header includes the IBM logo and navigation links for 'Collaboration Solutions Blog', 'Categories', 'Domino', and 'Collaboration Solutions Home'. The main content area has a black background with white text. It features the word 'Cognitive' in small letters, followed by a large, bold statement: 'Augmented Intelligence, NOT Artificial Intelligence!'

Interactive Artificial Intelligence

New programme for 2019



The image shows the logo for the Florida Institute for Human & Machine Cognition (IHMC). It features a stylized blue figure in motion to the left of the acronym 'ihmc' in a bold, lowercase font. Below the acronym, the full name 'FLORIDA INSTITUTE FOR HUMAN & MACHINE COGNITION' is written in a smaller, all-caps font.

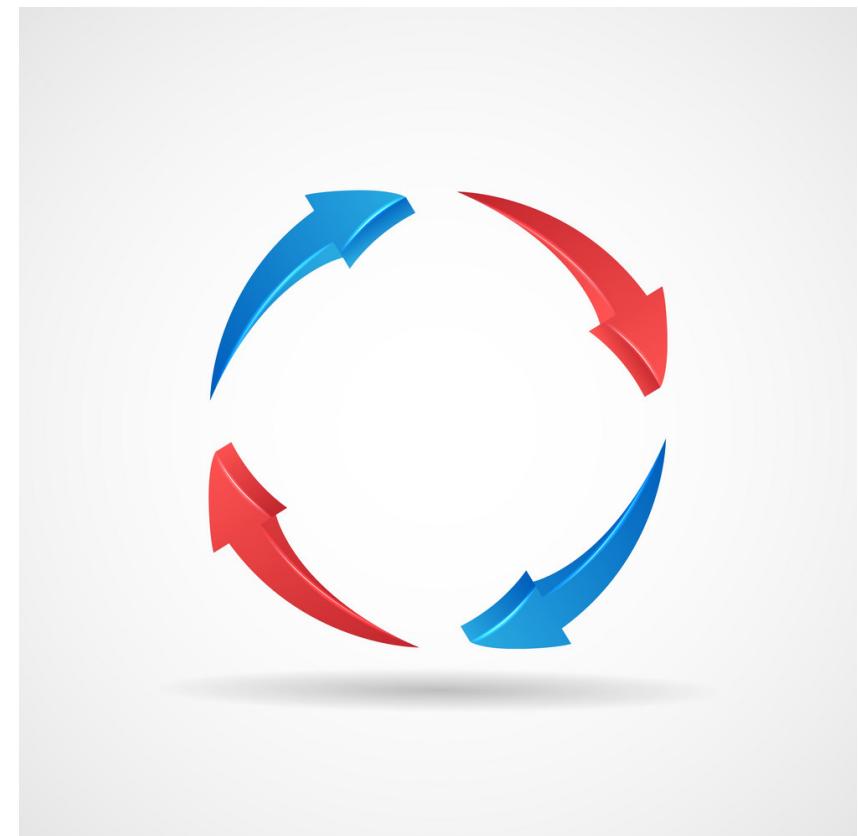
New approaches coming

These are all admirable, but often lack an underlying theoretical basis.

I argue that looking to the past, present and future of other media provides metaphors and guidelines to:

- Understand
- Design
- Deploy

AI/ML-based systems



Final thought

While acknowledging that AI can have many different goals including the creation of intelligent agents, another can be the creation of:

a new computation-based media in which human intellect can come to express itself with a different clarity and force

William Hill (1989) AI Magazine Volume 10 Number 2