AIhub

Science communication for AI researchers

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Dr Lucy Smith
AIhub.org and Scicomm.io

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news articles opinions education

- AIhub is a non-profit (UK charity) dedicated to connecting the AI community to the public by providing free, high-quality information.
- We are supported by many leading AI organisations.

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news articles opinions education

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What we'll cover

- Why science communication matters
- Different ways to do science communication
- Finding your story
- Communicating via social media
- Turning your story into a blog post
- How to find and use suitable images
- How to spot and avoid AI hype
- Unconventional ways to do science communication

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Aims

- By the end of the session, you should have the plan for a blog post.

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How do we communicate our work?

MACHINE LEARNING
Science and Technology

PAPER

On the capacity and superposition of minima in neural network loss function landscapes

Maximilian P Niroomand, John W R Morgan, Conor T Cafolla and David J Wales
Department of Chemistry, University of Cambridge, Cambridge, United Kingdom
Authors to whom any correspondence should be addressed.
E-mail: and

OPEN ACCESS

Keywords: ensemble learning, interpretability, loss function landscape, theoretical chemistry

Abstract

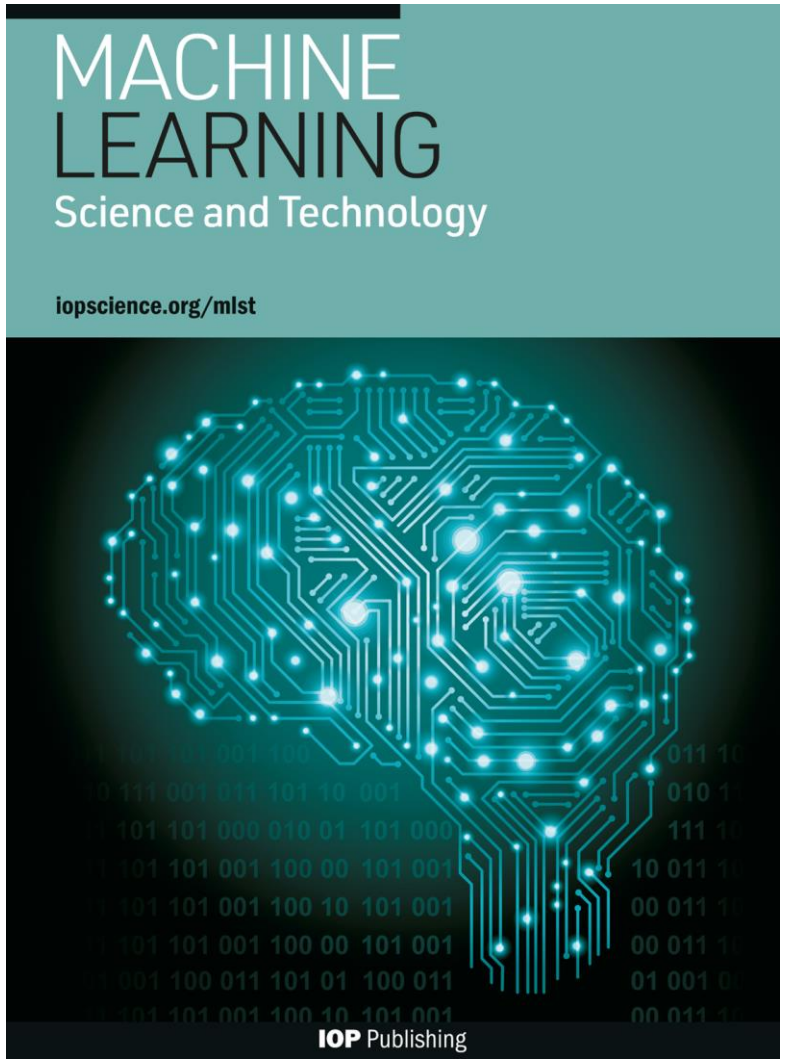
Minima of the loss function landscape (LFL) of a neural network are locally optimal sets of weights that extract and process information from the input data to make outcome predictions. In underparameterised networks, the capacity of the weights may be insufficient to fit all the relevant information. We demonstrate that different local minima specialise in certain aspects of the learning problem, and process the input information differently. This effect can be exploited using a meta-network in which the predictive power from multiple minima of the LFL is combined to produce a better classifier. With this approach, we can increase the area under the receiver operating characteristic curve by around 20% for a complex learning problem. We propose a theoretical basis for combining minima and show how a meta-network can be trained to select the representative that is used for classification of a specific data item. Finally, we present an analysis of symmetry-equivalent solutions to machine learning problems, which provides a systematic means to improve the efficiency of this approach.

1. Introduction

Deep learning with neural networks is a high-dimensional, non-convex optimisation problem for a loss function landscape (LFL). The coordinates of a minimum in the LFL are a *set of weights* for the machine learning model and a locally optimal *solution* to the learning problem, and these terms will therefore be used interchangeably throughout. It follows that the coordinates of the global minimum of the LFL are the weights that produce the lowest possible value of the loss function for the training data. The aim of machine learning is usually for the model to find a set of weights that fit the training data, but also generalise well to unseen testing data. Our approach extends this view. Instead of looking at just one minimum of the LFL, we are interested in the expressive power of multiple minima. To analyse how different minima extract and process information from the input data, we survey numerous low-lying minima of the LFL. Here, we employ tools from the energy landscape approach (Wales 2003) to gain new insight into machine learning LFLs (Ballard *et al* 2017). We note that the role of local minima is somewhat different in ML landscapes compared to molecular systems. While in a molecular energy landscape only minima provide valid configurations for a stable molecule, this restriction does not apply to LFLs for machine learning. In fact, some low-lying non-minima will have a smaller loss value and higher classification accuracy than a high-lying minimum. Here, we are interested in developing a better understanding of the capacity of diverse minima of the LFL, and we show that by combining the expressive power of different minima, we can build a better classifier. The compact form of this predictor provides a balance between accuracy and efficiency, which will be useful in applications where evaluation is a computational bottleneck.

1.1. Background

Machine learning models are structurally limited in the amount of data they can fit: their capacity is finite. The most commonly known measure of capacity is perhaps the Vapnik-Chervonenkis (VC) dimension (Vapnik and Chervonenkis 1971, Vapnik *et al* 1994). The higher the VC dimension, the more complex are the



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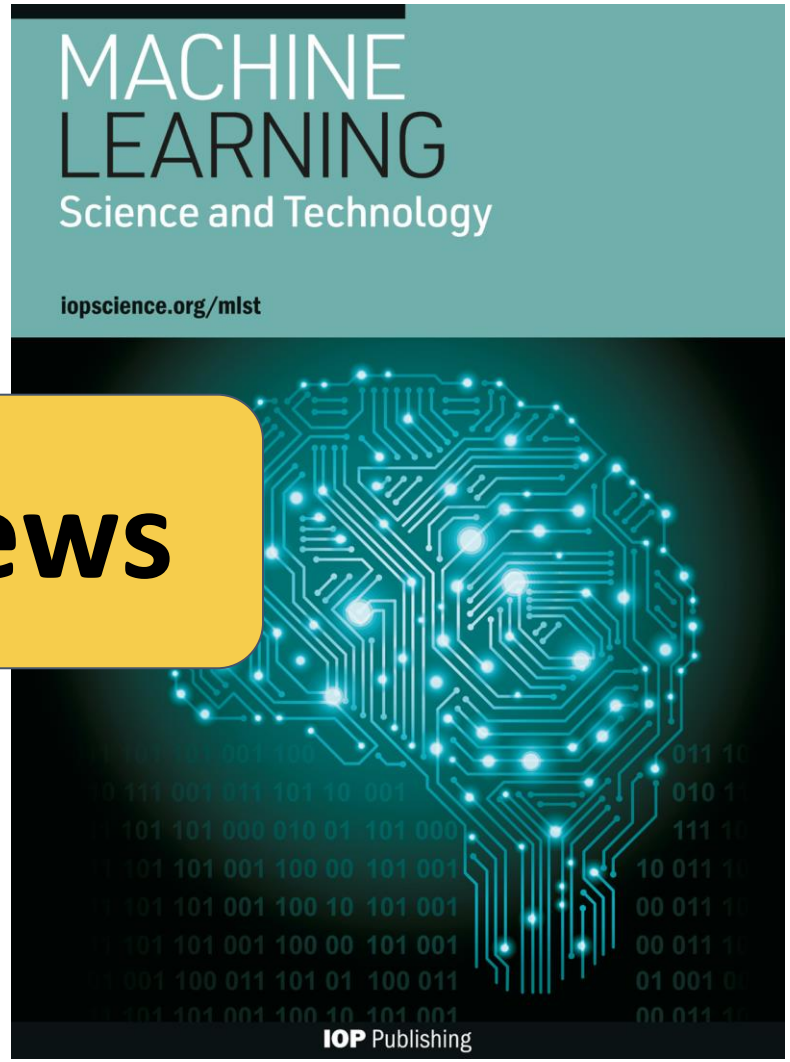
1000 views



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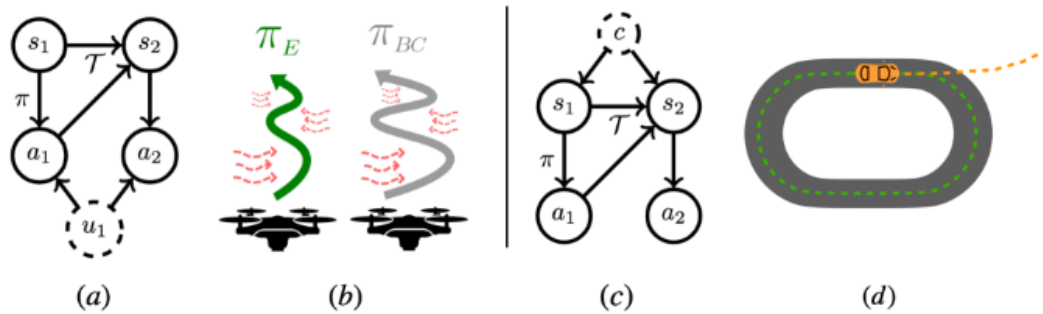
MLCMU

Causal Confounds in Sequential Decision Making

AUTHORS	AFFILIATIONS	PUBLISHED
Gokul Swamy	RI, CMU	November 28, 2022



A standard assumption in sequential decision making is that we observe everything required to make good decisions. In practice however, this isn't always the case. We discuss two specific examples (temporally correlated noise (a) and unobserved contexts (c)) that have stymied the use of IL/RL algorithms (in autonomous helicopters (b) and self-driving (d)). We derive provably correct algorithms for both of these problems that scale to continuous control problems.

Reinforcement Learning (RL) and Imitation Learning (IL) methods have achieved impressive results in recent years like beating the world champion at Go or controlling stratospheric balloons. Usually, these results are on problems where we either a) observe the full state or b) are able to faithfully execute our intended actions on the system. However, we frequently have to contend with situations where this isn't the case: our self-driving car might miss a person's hand gestures or persistent wind might make it difficult to fly our quadcopter perfectly straight. These sorts of situations can cause standard IL approaches to perform poorly ([1], [2]). In causal inference, we call a random variable that we don't observe that influences a relationship we'd like

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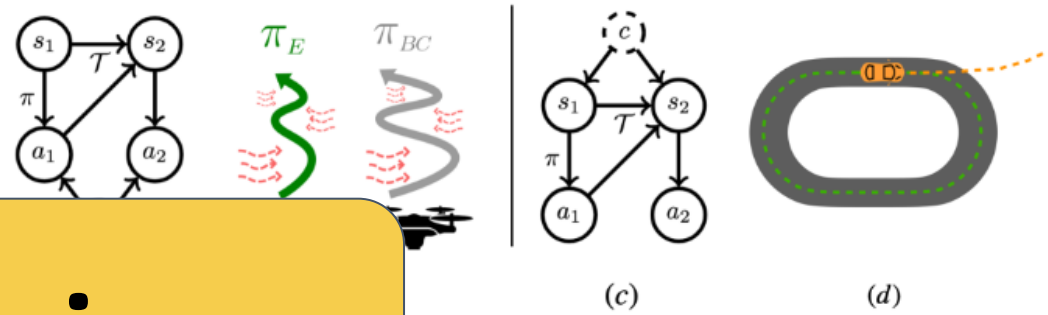

8000 views

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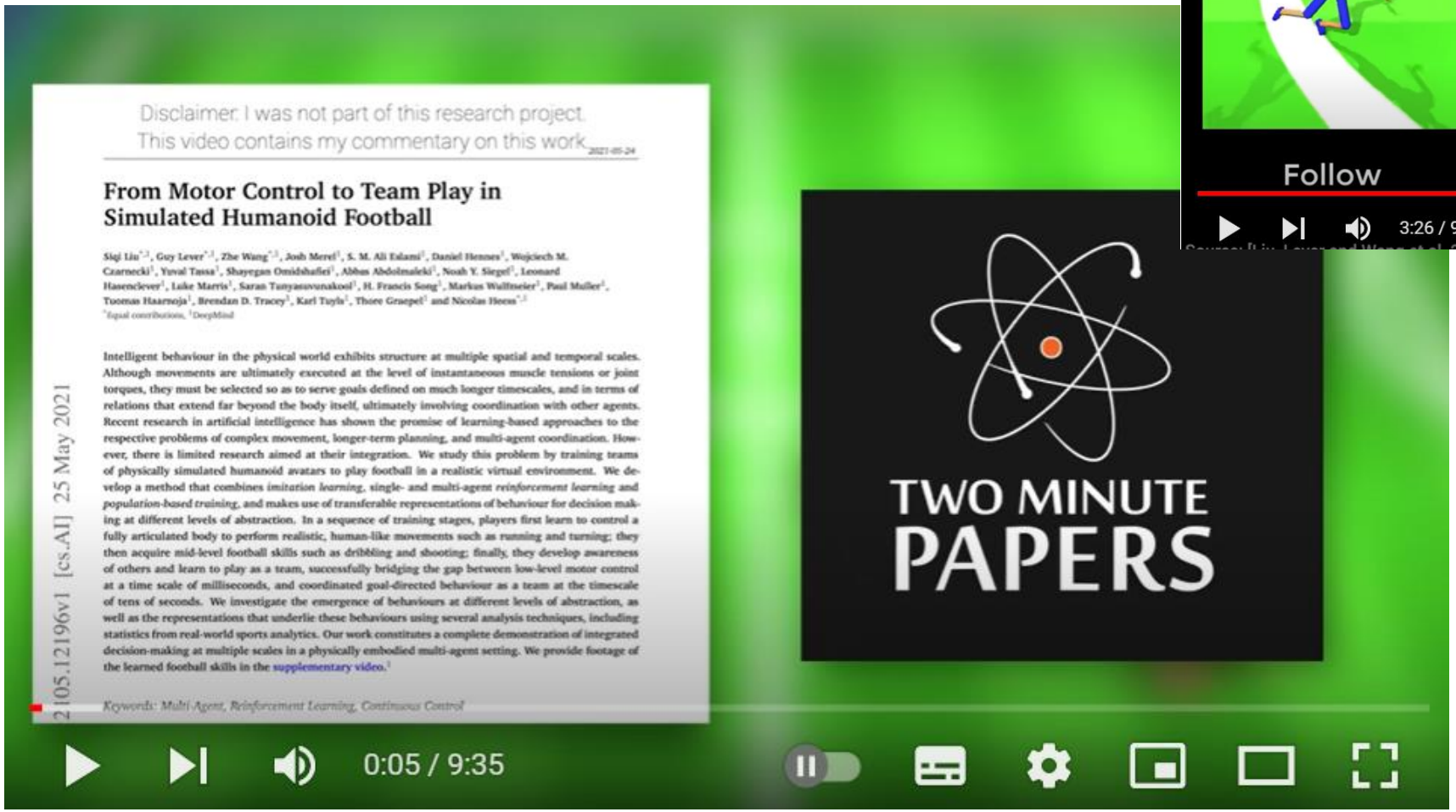

https://youtu.be/HTON7odbW0o

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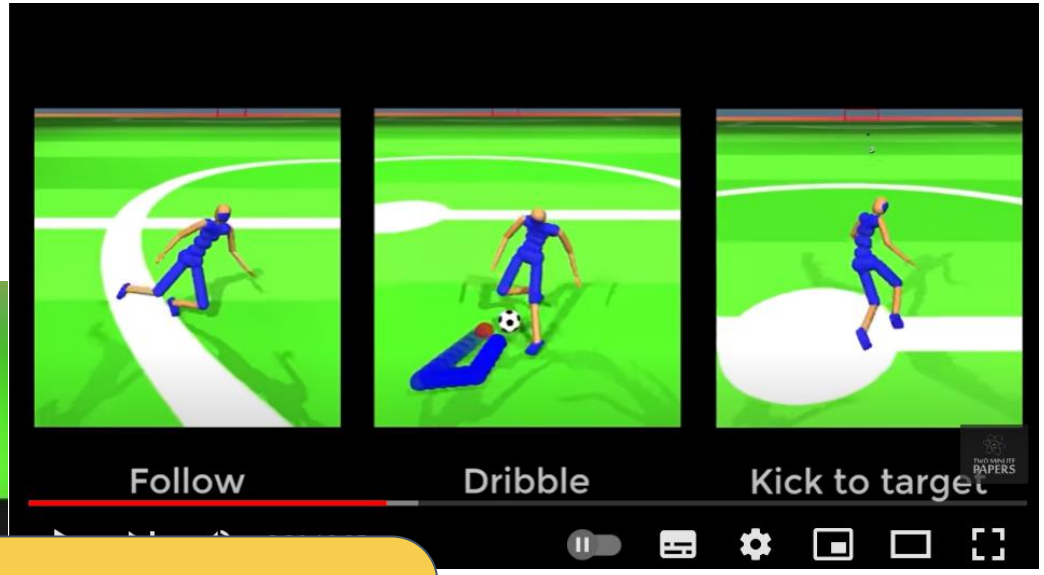

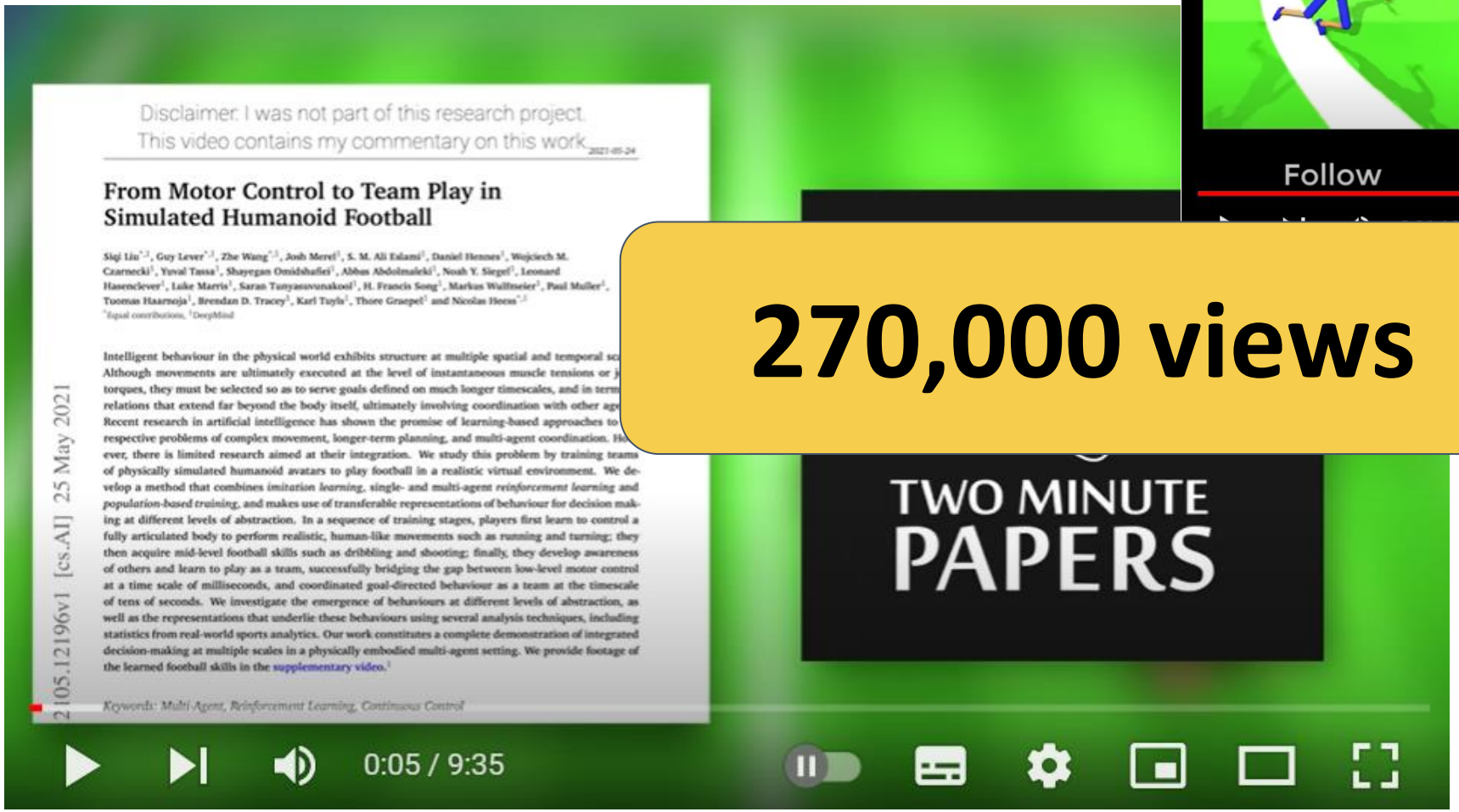

270,000 views

https://youtu.be/HTON7odbW0o

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The Guardian
News website of the year

Artificial intelligence (AI)

ChatGPT maker OpenAI releases 'not fully reliable' tool to detect AI generated content

OpenAI is calling on educators to give their feedback on how the tool is used, amid rising concerns around AI-assisted cheating at universities

Josh Taylor
@joshgnosis
Wed 1 Feb 2023 03.58 GMT

ChatGPT creator, OpenAI, has released a tool to detect AI generated content Photograph: Lionel Bonaventure/AFP/Getty Images

OpenAI, the research laboratory behind AI program ChatGPT, has released a tool designed to detect whether text has been written by artificial intelligence, but warns it's not completely reliable - yet.

In a blog post on Tuesday, OpenAI linked to a new classifier tool that has been trained to distinguish between text written by a human and that written by a variety of AI, not just ChatGPT.

Open AI researchers said that while it was "impossible to reliably detect all AI-written text", good classifiers could pick up signs that text was written by AI. The tool could be useful in cases where AI was used for "academic

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> 1 million views?

Circulation of 9 million

Why science communication matters

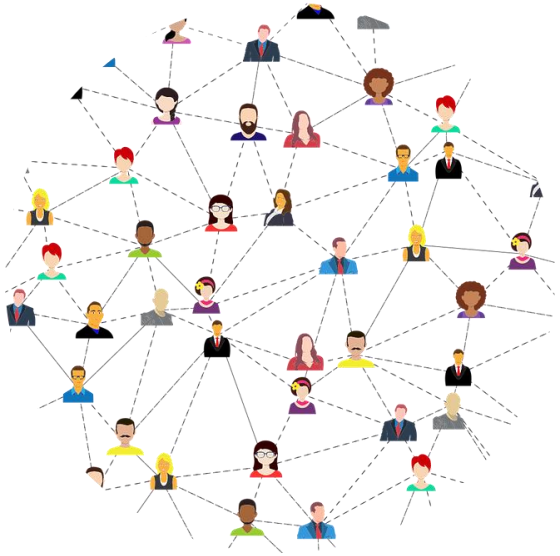
- Inspiring the next generation
- Science for society
- Transparency
- De-hyping science
- Adding value to the research

Why science communication matters
(https://youtu.be/hHFltr_j4FI)

Why don’t more people do science communication?

Don’t know how

Don’t have time



Don’t have an audience

Have you done any science communication before?

Different ways to do science communication

- TV, public talks, radio
- Blog posts
- Collaboration with artists
- Workshops
- Competitions
- Social media
- Podcasts
- Exhibitions

Different ways to do science communication (https://youtu.be/Jb8eRfItOLE)

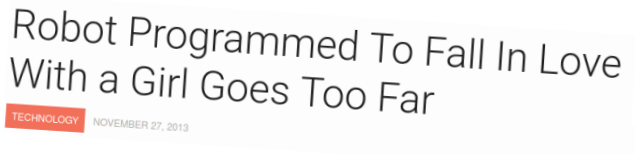
Getting started: the simplest way

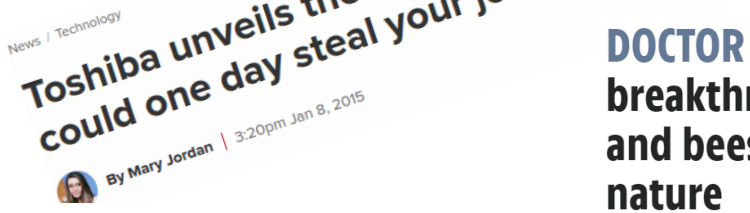
- Your press office
- Science journalists
- Established blog sites

How to approach the media: An interview with Evan Ackerman (https://youtu.be/5kslhRzoDRw)

The importance of owning your sci-comm

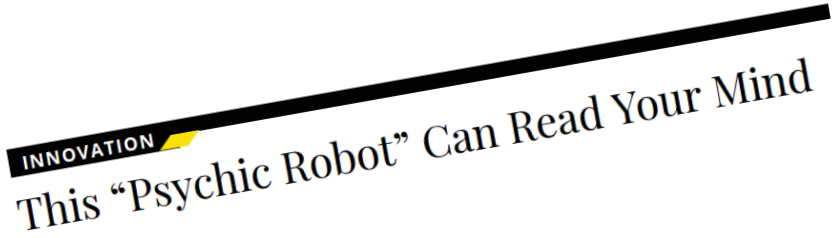
- When someone else reports on your work you lose control over the content.





'KILLER' BOTS Rogue superhuman AI 'could kill everyone' and wipe out human race... the tech should be controlled like nukes

DOCTOR DOLITTLE Artificial intelligence breakthrough lets humans 'talk' with bats and bees 'changing what we know' about nature



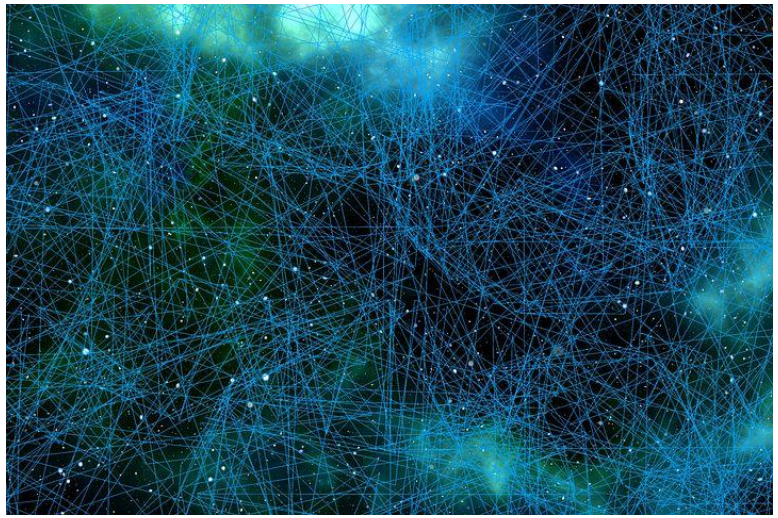
A starting point to communicating directly: social media

A starting point to communicating directly: social media

- Ways to use social media for your research:
  - Passive
  - Active

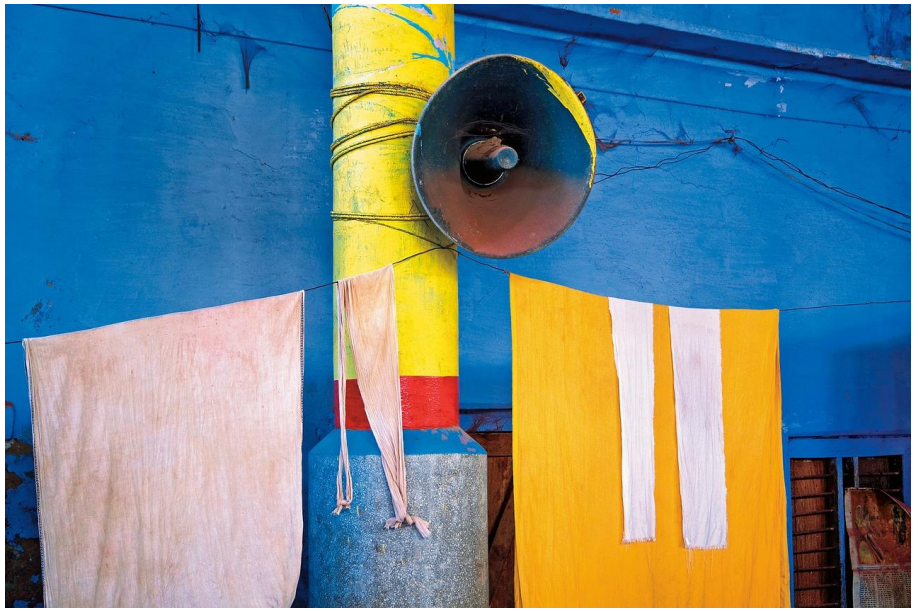
How using social media can benefit your research - passive

- Follow other researchers in the field.
  - Who do they follow?
  - Follow their followers.
  - Build your network.
- Find out about events / workshops / other interesting content.
- Find out about grants / positions / opportunities.
- Follow journalists.



How using social media can benefit your research - active

- Use to promote your research.
  - Can be a great tool for refining your message.
  - How to compress your research into a tweet, or thread.
- Engage in discussions.
- Build connections with other researchers, journalists, organisations.
- Feel part of a community.
- Amplify the voices of others.



Caveats

- Can be easy to get sucked into controversies and arguments.
- Short-form of tweets (for example) often not conducive to in-depth discussions.

Finding your story

Finding your story

Story is an ancient technology that can be used to share knowledge, information and culture easily and quickly. It's a free technology to all humans. So, if you're not using story, you're working harder that you have to.

Clare Murphy,
Storyteller

Activity: your story as tweets

The questions:

- What problem are you trying to solve?
- What is the current state of the field?
- How does this relate to people's lives?
- Why is it important to you?
- What's your contribution?
- What are your main findings?
- What challenges did you face?
- What are the limitations of your contribution?
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Your story as tweets

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General efficiency is good, but we still need to improve it. For organic LEDs there has been much success with red and green light, but blue is proving more of a challenge.

Your story as tweets

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Our industrial partners are working on the next generation of displays for use in televisions, computer screens and mobile phones. OLEDs offer the potential for flexible, printable displays.

Example from a ML research paper

IOP Publishing Mach. Learn.: Sci. Technol. 3 (2022) 045034 https://doi.org/10.1088/2632-2153/aca23d

MACHINE LEARNING
Science and Technology

PAPER

Self-supervised learning of materials concepts from crystal structures via deep neural networks

Yuta Suzuki[1,2,6], Tatsunori Taniai[3], Kotaro Saito[2,4], Yoshitaka Ushiku[3] and Kanta Ono[1,2,5,*]

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[2] Institute of Materials Structure Science (IMSS), High Energy Accelerator Research Organization (KEK), Ibaraki, Japan
[3] OMRON SINIC X Corporation, Tokyo, Japan
[4] Randeft, Inc., Tokyo, Japan
[5] Department of Applied Physics, Osaka University, Osaka, Japan
[6] Current affiliation: Advanced R&D and Engineering Company, TOYOTA MOTOR CORPORATION, Shizuoka, Japan.
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Keywords: materials informatics, deep metric learning, crystal structure, self-supervised learning

Supplementary material for this article is available online

CrossMark

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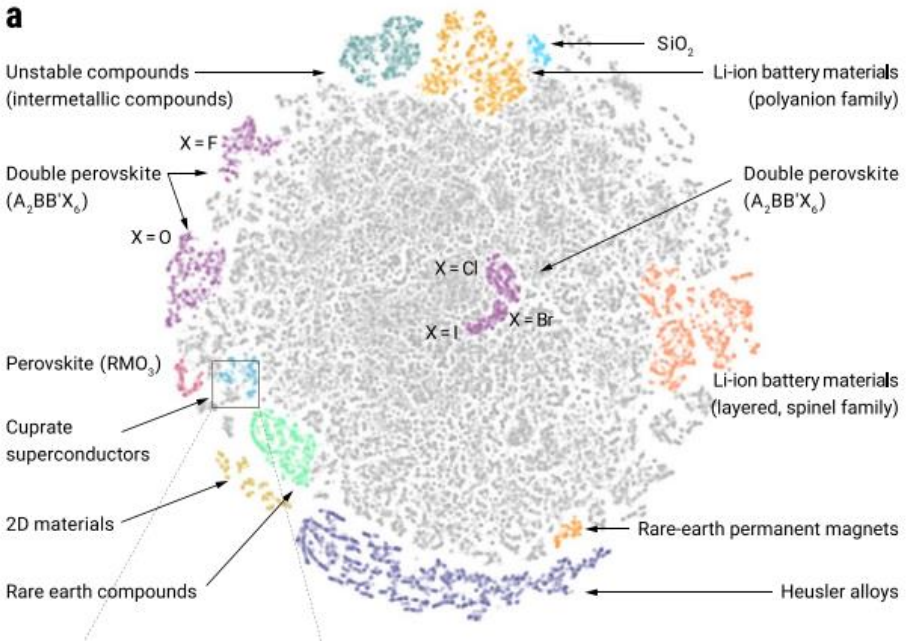

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The development of new materials is a slow process that involves searching through a vast space of potential structures. Suzuki *et al* are using machine learning techniques to find relationships between the structure of a material and its properties.

Your story as tweets

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Suzuki *et al* have used a self-supervised deep learning approach to learn material embeddings from crystal structures of over 120 000 materials to capture relationship between the structure of a material and its functions.

Your story as tweets

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The authors found strong similarities between materials, such as cuprate superconductors and lithium-ion battery materials. This enabled them to draw a large-scale map of the materials space, capturing various materials concepts. They could also measure the functional similarities between materials.

Turning your story into a blog post

What makes a good story?

- Connects with the audience. Evokes their lived experiences, likes, passions, concerns.

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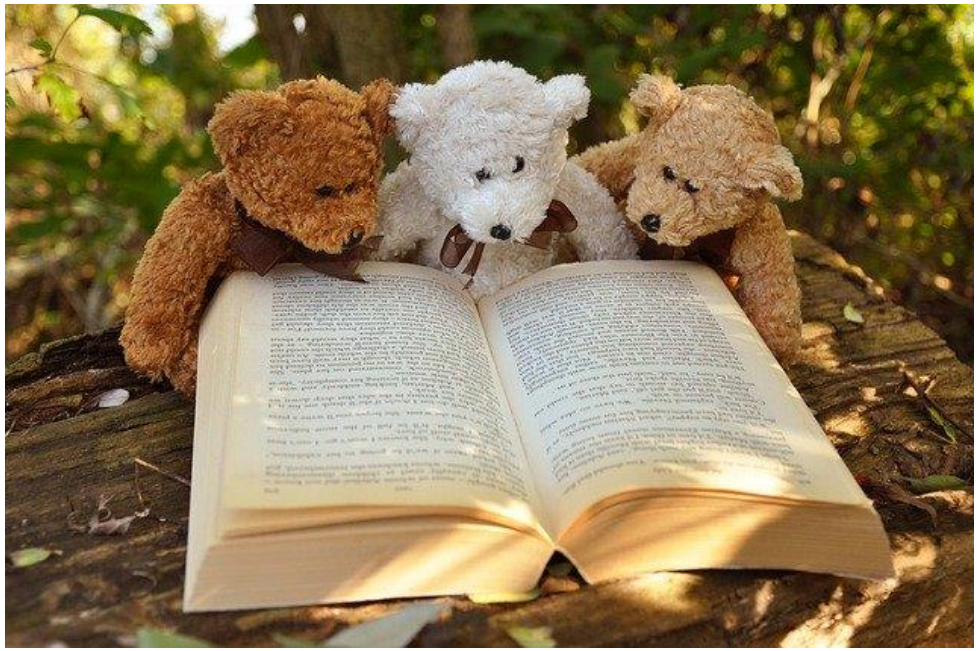
- Has a structure and natural flow.

Tips on writing a blog post

- Know your audience - who are you writing for?



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- The next step: expand your tweets into paragraphs. Clarify, explain and give examples.
- Read, re-read and seek feedback.

Activity: expand your tweets into paragraphs

Turning your tweets into a blog post

We are trying to understand the underlying physics behind multi-layered microstructures so that experimentalists can construct more efficient organic LEDs.

With the urgent need to reduce our energy consumption, it is essential that any devices we use are as efficient as possible. A large part of energy usage in these electronic devices comes from the screens. Of the various solutions, organic light-emitting diodes (OLEDs) present an efficient option.

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Turning your tweets into a blog post

Our industrial partners are working on the next generation of displays for use in televisions, computer screens and mobile phones. OLEDs offer the potential for flexible, printable displays.

The insights that we provide to our industrial partners are used to inform their designs of the next generation of displays for use in televisions, computer screens and mobile phones. As well as the energy efficiency benefits that OLEDs can bring, the microscale nature of OLED structures means that they can be printed directly onto a flexible substrate. This opens up many possibilities for new and exciting devices. As well as rollable and foldable screens, there is also great potential for wearable technologies.

Example from a ML research paper

IOP Publishing Mach. Learn.: Sci. Technol. 3 (2022) 045034 https://doi.org/10.1088/2632-2153/aca23d

MACHINE LEARNING
Science and Technology

PAPER

Self-supervised learning of materials concepts from crystal structures via deep neural networks

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Turning your tweets into a blog post

The development of new materials is a slow process that involves searching through a vast space of potential structures. Suzuki *et al* are using machine learning techniques to accelerate the process of finding the relationships between the structure of a material and its properties.

Imagine you are working on developing a new inorganic material for an efficient battery. Where do you start? How do you go about finding that material? What structure would give you the properties you are looking for? In the past, this would have involved a time-consuming experimental fabrication process, most likely informed by first-principles theoretical models. However, given the sparsity of materials in a vast search space, the process of discovering and fabricating a new material could take many years.

Now, imagine you could accelerate part of this process and narrow your search. The key to doing this is through understanding the relationships between the crystal structures of materials and their functional properties, as the diverse properties of inorganic materials originate from their crystal structures. In their research, Suzuki *et al* are using machine learning techniques to create a map of the materials space.

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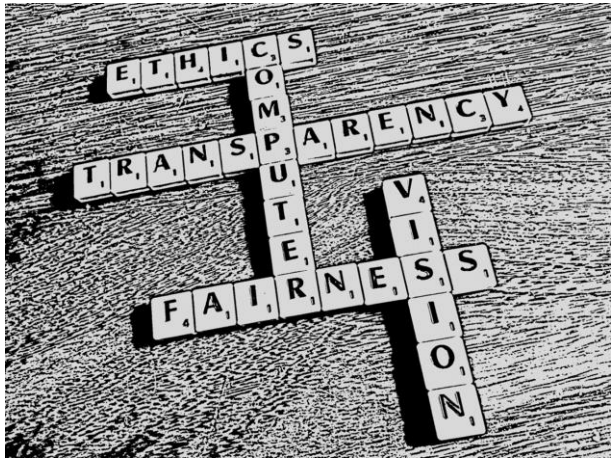
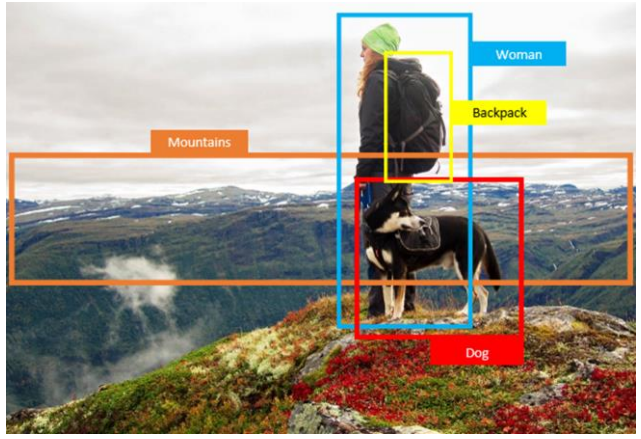
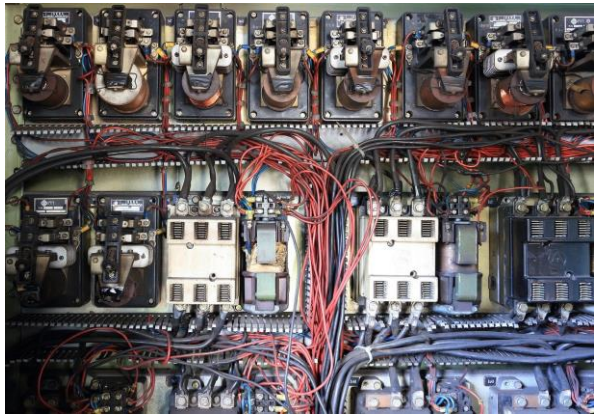
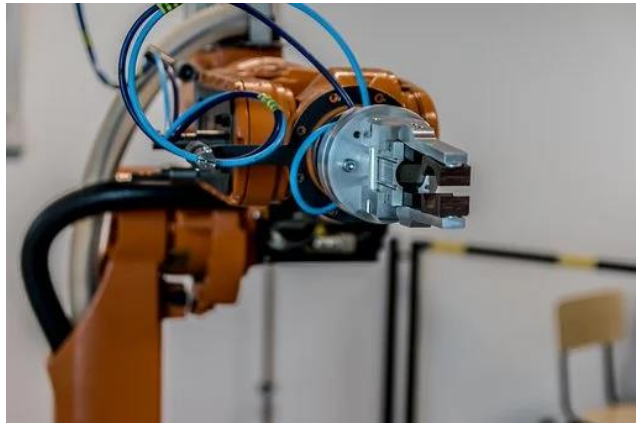
Creating a portfolio of media









Creating a portfolio of media

Enhancing your blog posts with images and videos is important for two reasons.

- It can help increase the visual impact of your work.

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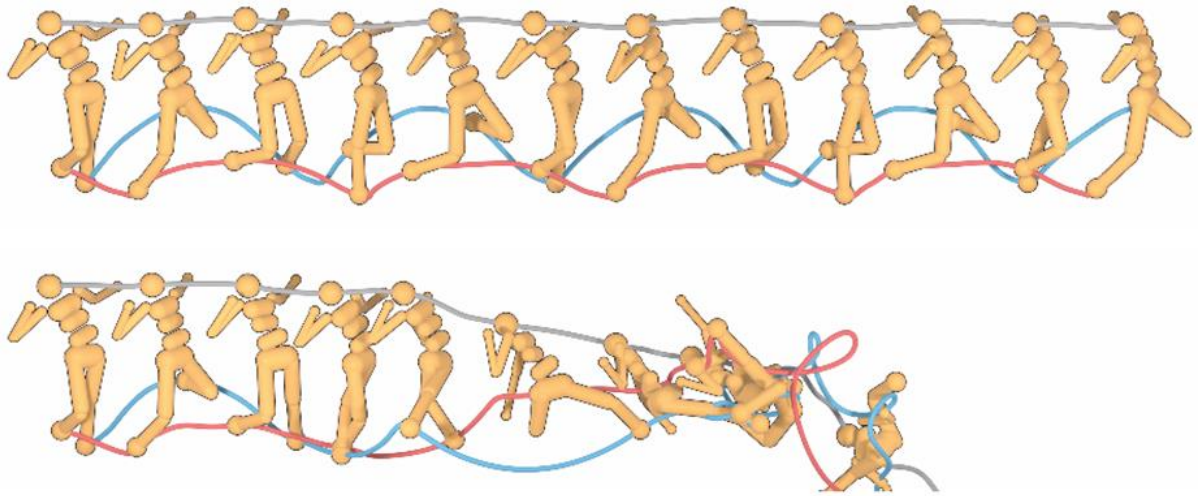
- It can help increase the visual impact of your work.
- It aids the understanding of concepts you are describing.



Credit: Michael Janner. From BAIR blog.

Creating a portfolio of media

- Option 1: use photos, graphs, images from your own research.

Credit: Guillem Alenya

Creating a portfolio of media

- Option 1: use photos, graphs, images from your own research.
- Option 2: create your own images.

Creating a portfolio of media

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- Option 1: use photos, graphs, images from your own research.
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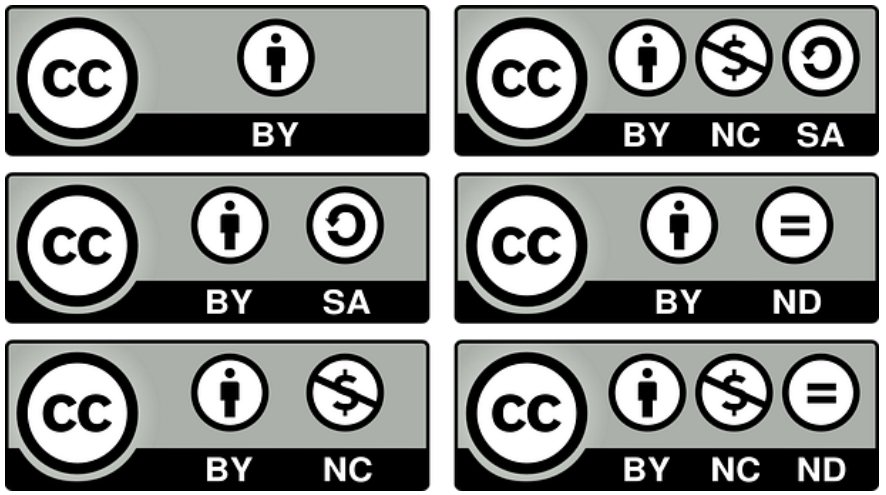
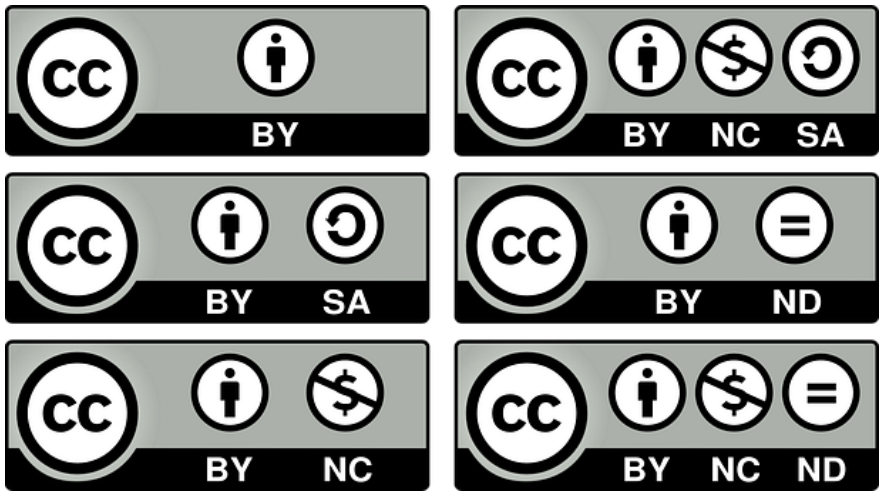
- Option 3: buy stock images.
- Option 4: use images freely available online.
  - Be sure to check the license conditions for reproducing the image.



Creative commons licenses

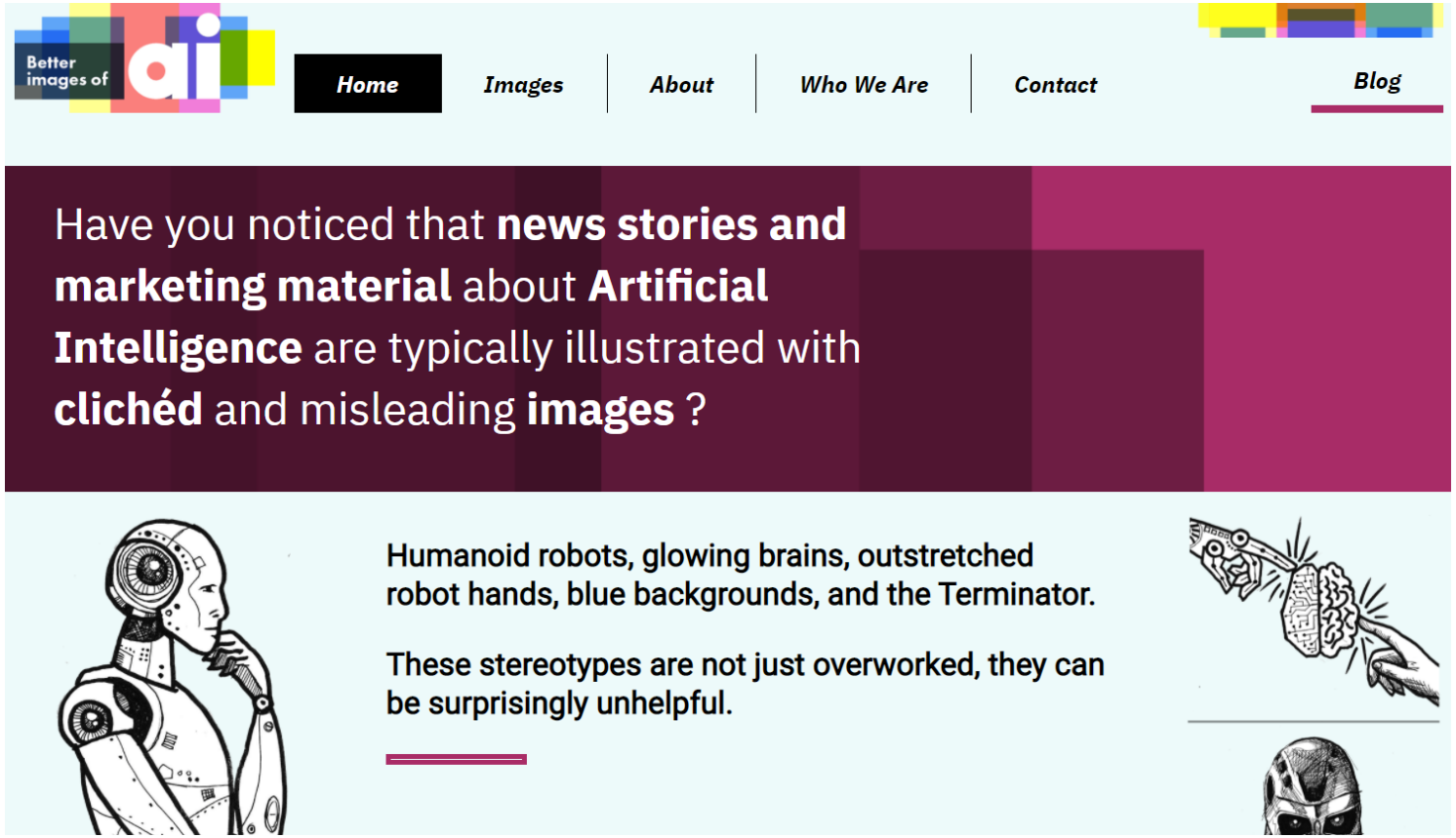
- Creative Commons is a nonprofit organization that helps overcome legal obstacles to the sharing of knowledge and creativity.
- Provide Creative Commons licenses and public domain tools that give every person and organization in the world a free, simple, and standardized way to grant copyright permissions for creative and academic works; ensure proper attribution; and allow others to copy, distribute, and make use of those works



Better Images of AI

Better Images of AI

https://betterimagesofai.org/



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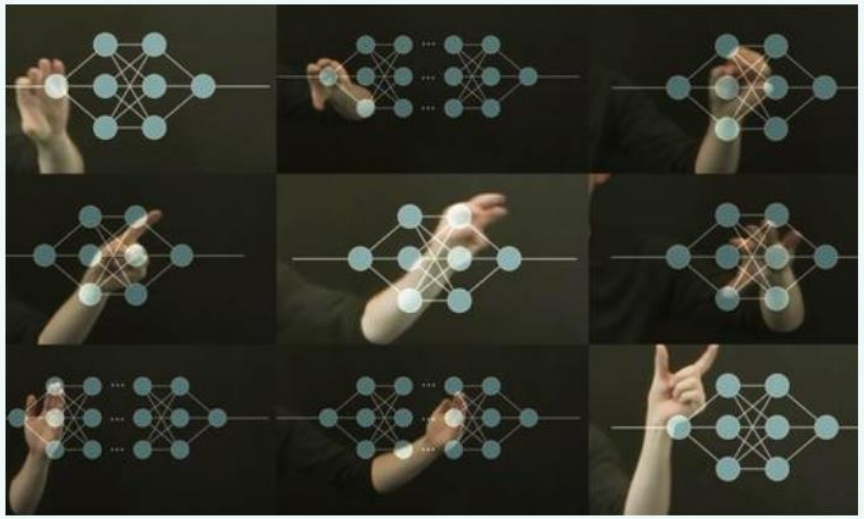
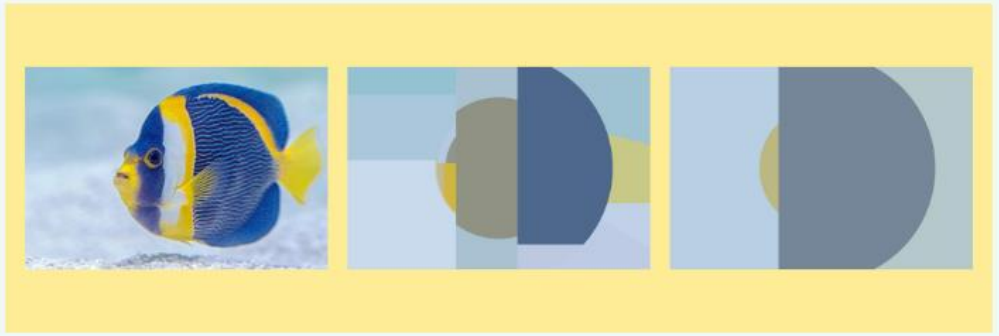


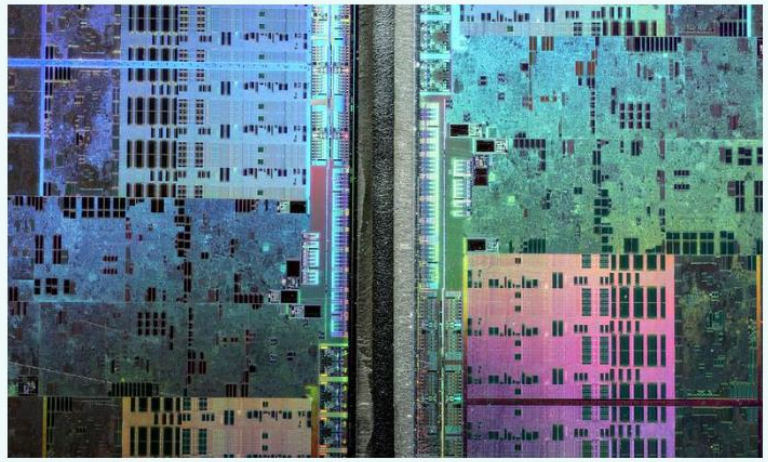
Explainable AI - Alexa Steinbrück



Fish reversed - Rens Dimmendaal & David Clode

Autonomous Driving - Anton Grabolle

Quantified Human - Alan Warburton



GPU shot etched 5 - Fritzchens Fritz

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AI-generated art

- What do you think about AI-generated art?
- Have you used it? / Would you use it?

“Created” using Stable Diffusion, with the prompt “AI-generated art”.

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Creating a portfolio of media

- https://pixabay.com/
- https://unsplash.com/
- https://snappygoat.com/
- https://www.pexels.com/
- https://burst.shopify.com/
- https://www.flickr.com/

Activity: find images for your work

Hype

Whilst it can be good to create a buzz around your research, too much hype tends to:

- Set inflated expectations about the technology,
- Drive unnecessary fears in the general public,
- Detracts from meaningful discussions about the actual aspects of the technology that we need to be concerned about.

Tips for avoiding hype in your sci-comm

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- Don’t exaggerate the impact of your work:
  - Be specific about your contribution.
  - Make any limitations clear.

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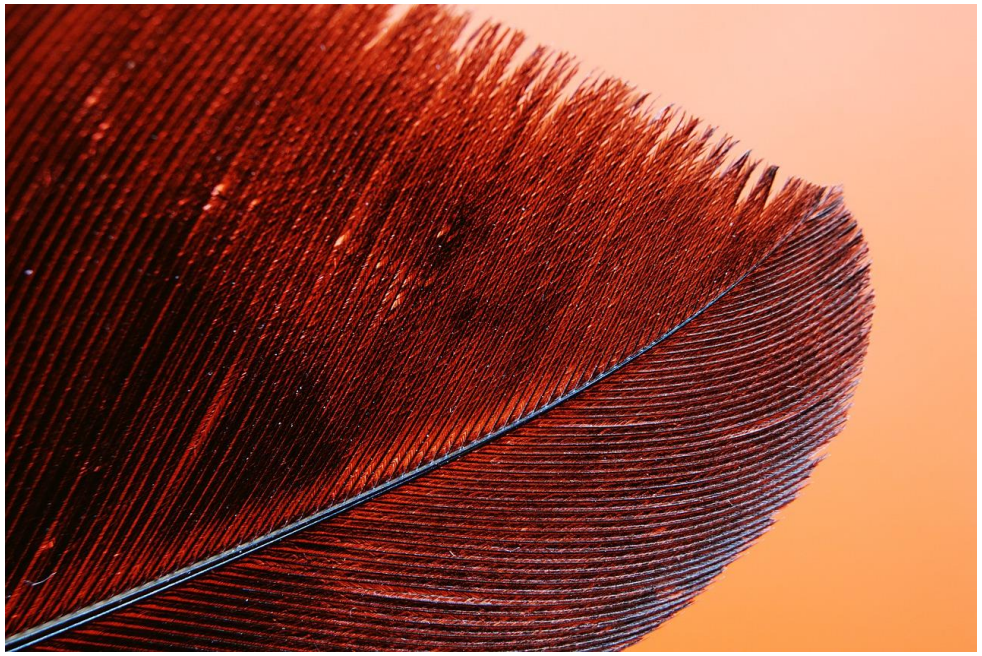
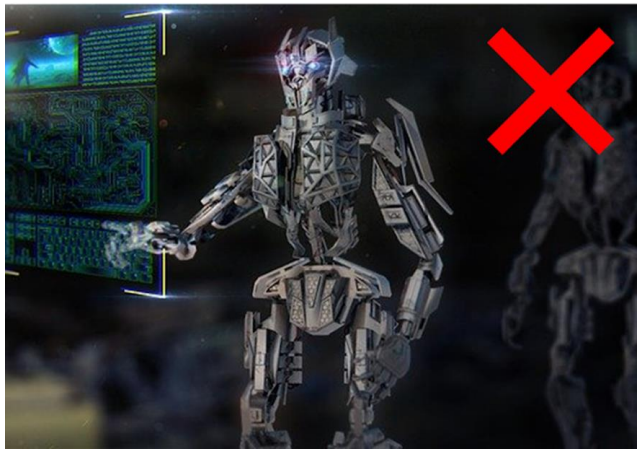


Tips for avoiding hype in your sci-comm

- Don’t exaggerate the impact of your work:
  - Be specific about your contribution.
  - Make any limitations clear.
- Avoid anthropomorphism.
- Prioritise scientific accuracy in your headline.
- Choose relevant images: avoid stereotypical images of robots from science fiction!



Activity: Check your blog post / tweets for hype

Hype in the headlines

Spotting hype in headlines

- Hyped?
- Not hyped?
- Somewhere in between?

DEATH BY DROID Killer robots are now ‘urgent threat to humanity’ and should be BANNED, shock report warns

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DEATH BY DROID Killer robots are now ‘urgent threat to humanity’ and should be BANNED, shock report warns

Towards mapping unknown environments with a robot swarm

AIhub

Towards mapping unknown environments with a robot swarm

Artificial intelligence powers record-breaking all-in-one miniature spectrometers

Artificial intelligence powers record-breaking all-in-one miniature spectrometers

Using machine learning to improve all-in-one miniature spectrometers

Examples from the press - the good, the bad, and the misleading

Example of good journalism

Search UK edition

The Guardian

For 200 years

News website of the year

Artificial intelligence (AI)

Artificial intelligence beats eight world champions at bridge

Victory marks milestone for AI as bridge requires more human skills than other strategy games

Laura Spinney

Tue 29 Mar 2022 06.00 BST

AIhub

Example of good journalism

Describes why this is significant
The victory represents a new milestone for AI because in bridge players work with incomplete information and must react to the behaviour of several other players – a scenario far closer to human decision-making.

Three paragraphs about how exactly the competition worked
The NukkAI challenge required the human champions to play 800 consecutive deals divided into 80 sets of 10…… The score was the difference between those of the human and the AI, averaged over each set. NooK won 67, or 83%, of the 80 sets.

Clearly states the limitations
It did not involve the initial bidding component of the game during which players arrive at a contract that they must then meet by playing their cards.

Quotes from trustworthy experts in the field

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Example of hyped and factually incorrect journalism

Mirror

Humanoid robots will 'take over the world' and professor warns we won't be able to spot them

Robotics expert Noel Sharkey says androids will soon be completely integrated in society working as shop assistants, bar staff and careworkers

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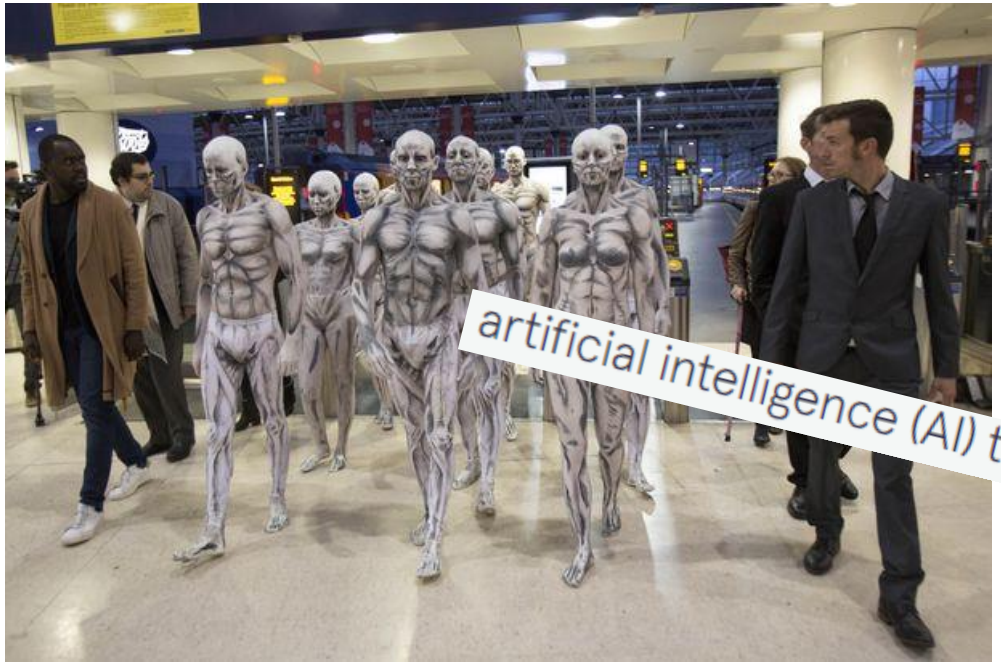
Example of hyped and factually incorrect journalism



Humanoid **robots** will take over the world

Terminator,

slowly creep into our lives

artificial intelligence (AI) technology as our "biggest existential threat".

dystopian future

"We are likely to see robots integrated into society in the near future as shop assistants, receptionists, doctors, bar tenders and also as carers for our elderly and children.

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Example of misleading journalism

A robot wrote this entire article. Are you scared yet, human?

GPT-3

We asked GPT-3, OpenAI's powerful new language generator, to write an essay for us from scratch. The assignment? To convince us robots come in peace

Example of misleading journalism

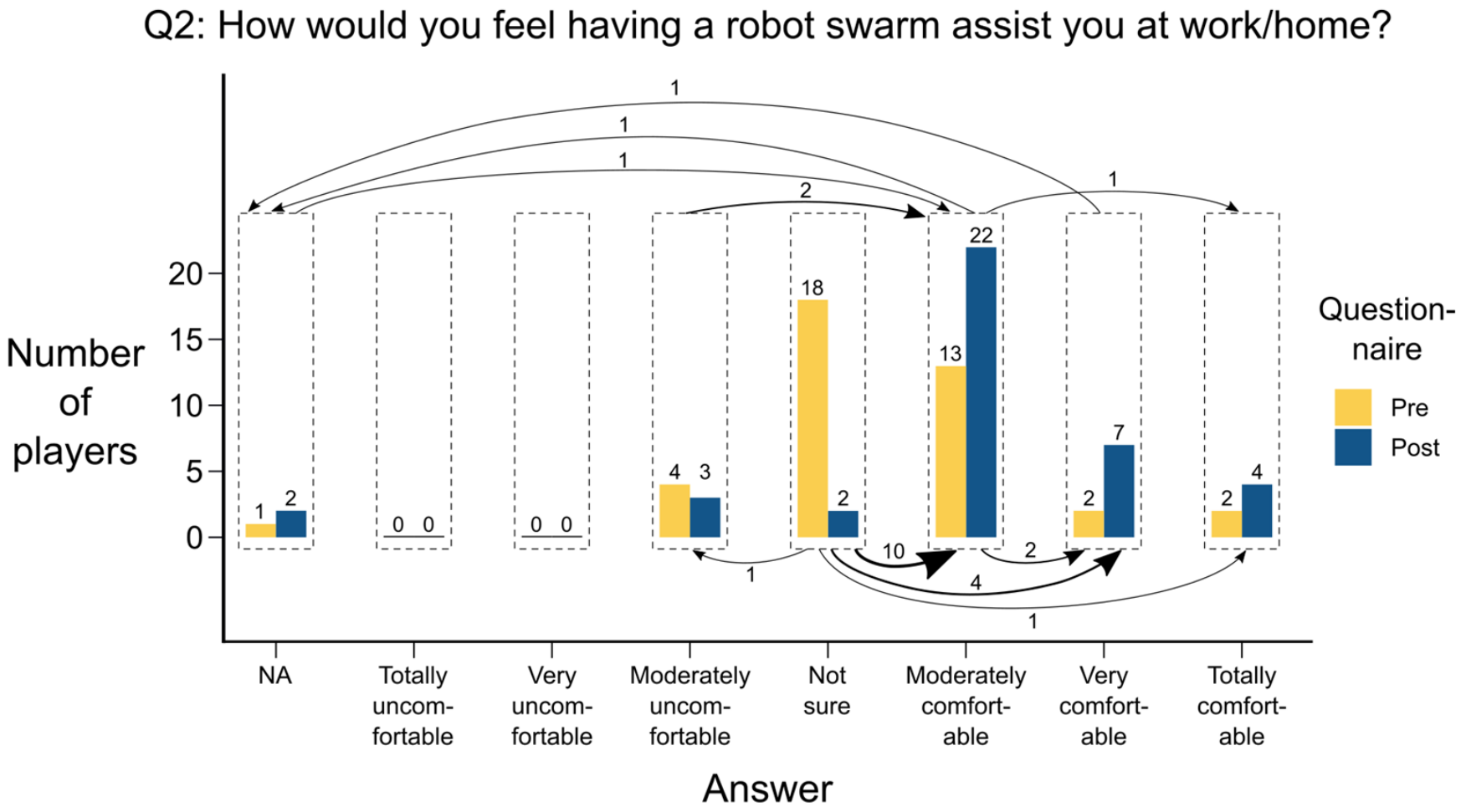
- Very misleading and hyped headline.
- Actual piece was a mixture of sentences taken from different articles produced by GPT-3, which were then curated and edited by a human editor.
- We are only told this right at the end of the piece.

Unconventional ways of doing sci-comm

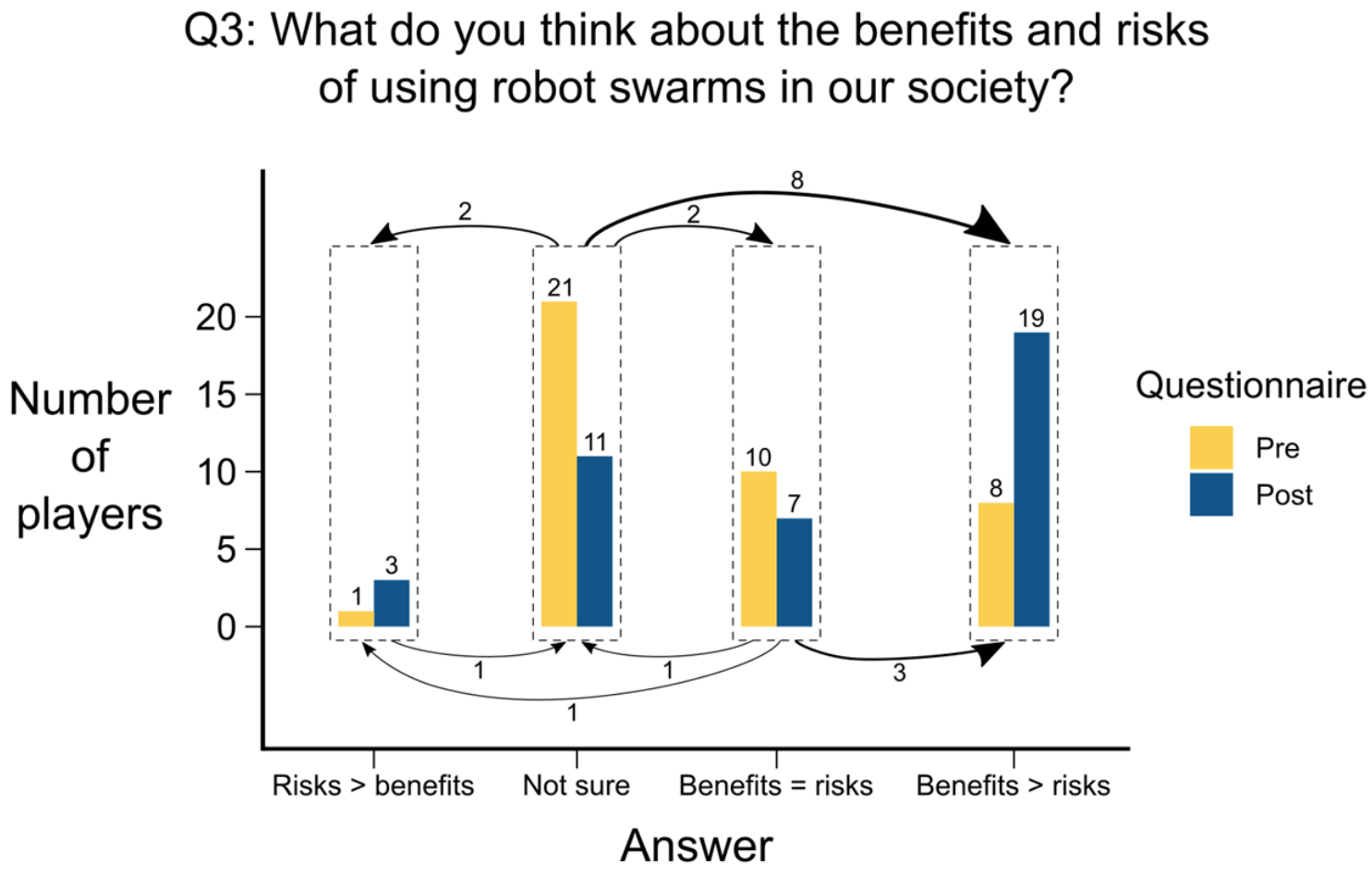
Unconventional ways of doing sci-comm: *swarm escape!*

Unconventional ways of doing sci-comm: *swarm escape!*

Dani's PhD experience: *engaging the public*



Dani's PhD experience: *engaging the public*



“Unconventional sci-comm” game

Instructions

1. Split into groups of 4 people
2. Number your groups with a unique number, consecutively starting from 1
3. Choose the story of one person at random from the group

…

“Unconventional sci-comm” game

… Now, as a group, choose one of the three formats below **given your assigned number**, and come up with an idea or a plan of how to tell the story of the chosen person using that format.

1. **Who’s your audience?**
2. **What part(s) of the story can you communicate better using this format?**
3. **What are the advantages of this format?**
4. **What are the challenges?**

Number 1
1) A stand-up monologue
2) A short film
3) A sci-fi book

Number 2
1) A dance choreography
2) A photograph collection
3) A food dish

Number 3
1) A comic
2) An escape room
3) A sitcom

Number 4
1) A theatre play
2) A painting
3) A sculpture

Number 5
1) A performance at a music festival
2) A book for children
3) A video game

Summary

- You have the tools to communicate about your work.
- Get out there and do it!

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