



4-8 April, 2022, Athens, Greece

1st DEDS Winter School | Ethical and Legal Aspects of Data

Reproducibility & Quality Assurance

7 April 2022

Dr Natasa Milic-Frayling

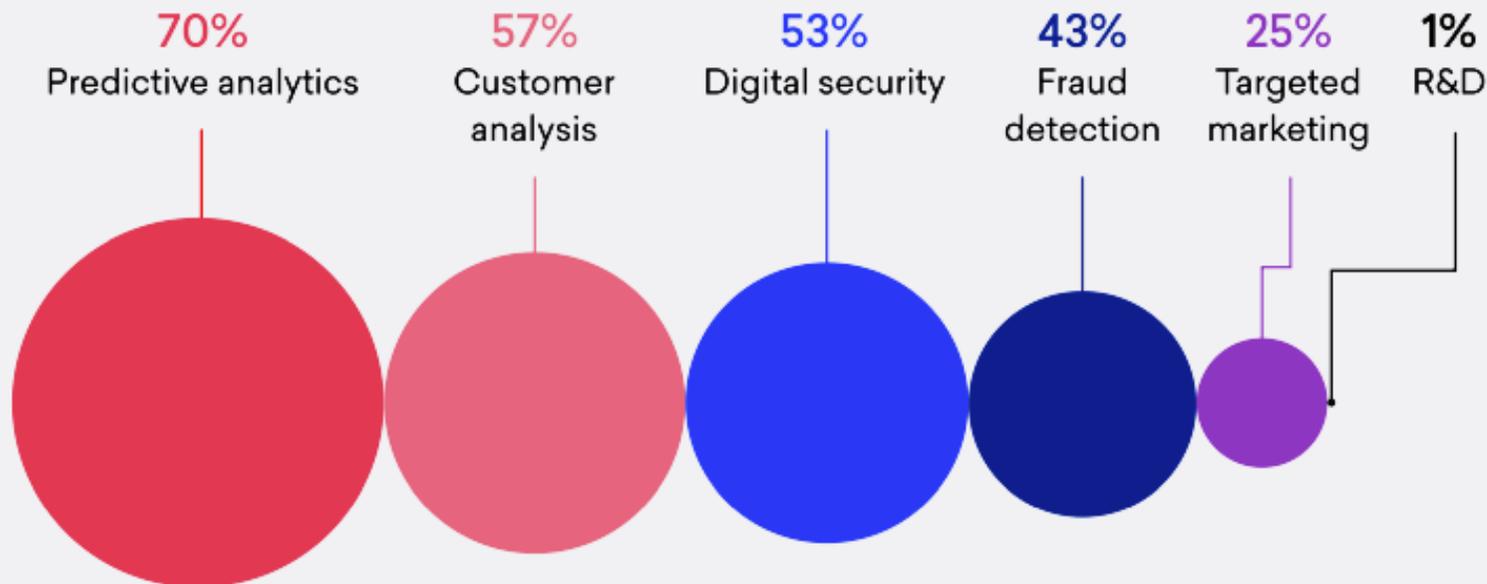
CEO, Intact Digital Ltd

Professor Emerita, University of Nottingham





WHICH OF THE FOLLOWING USE CASES ARE YOU LOOKING TO GAIN INSIGHT ABOUT/SOLVE USING DATA FROM YOUR AI/ML INITIATIVES?



Red Hat and Pulse surveyed 100 enterprise IT and data leaders who use AI and ML to uncover why they implemented the technology, the types of AI/ML tools they rely on, and the most popular initiatives they're investing.

[cl-open-source-cloud-based-ai-analyst-material-f27925-202103.pdf](https://www.redhat.com/en/topics/ai/ml-open-source-cloud-based-ai-analyst-material-f27925-202103)
(redhat.com)

In practice, quality assurance is restricted to problem remediation rather than problem prevention. Practitioners rely on community support.

A typical knowledge acquisition involves inquiring

- Has anyone solved the problem on a different data set?
- Has anyone solved the problem in a different domain?
- Is the problem known as being intractable at this point?
- What would make it possible to solve the problem?

Machine Learning, Deep learning and Data Science computing relies on computing architectures that involve reusable components.

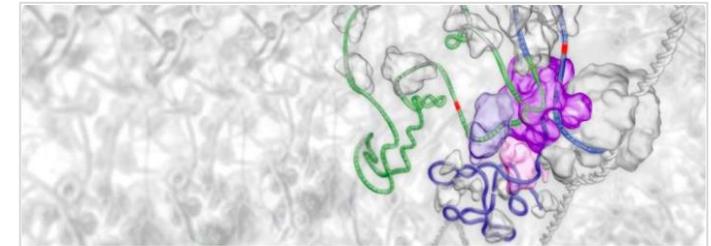
- At which point is it necessary to dig deeper into the building blocks and start building new ones?

New approaches and technologies serve as **differentiators**

- Start-ups often bring disruptive technologies and business models into the market place

Once established and proven beneficial, the new technology becomes a **requirement**

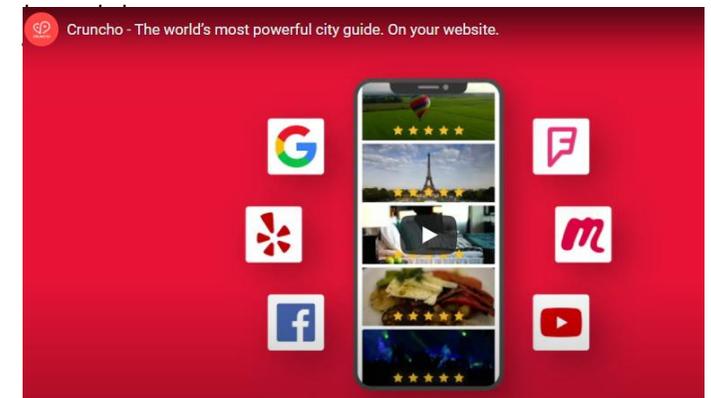
- If not included, the product is outdated.



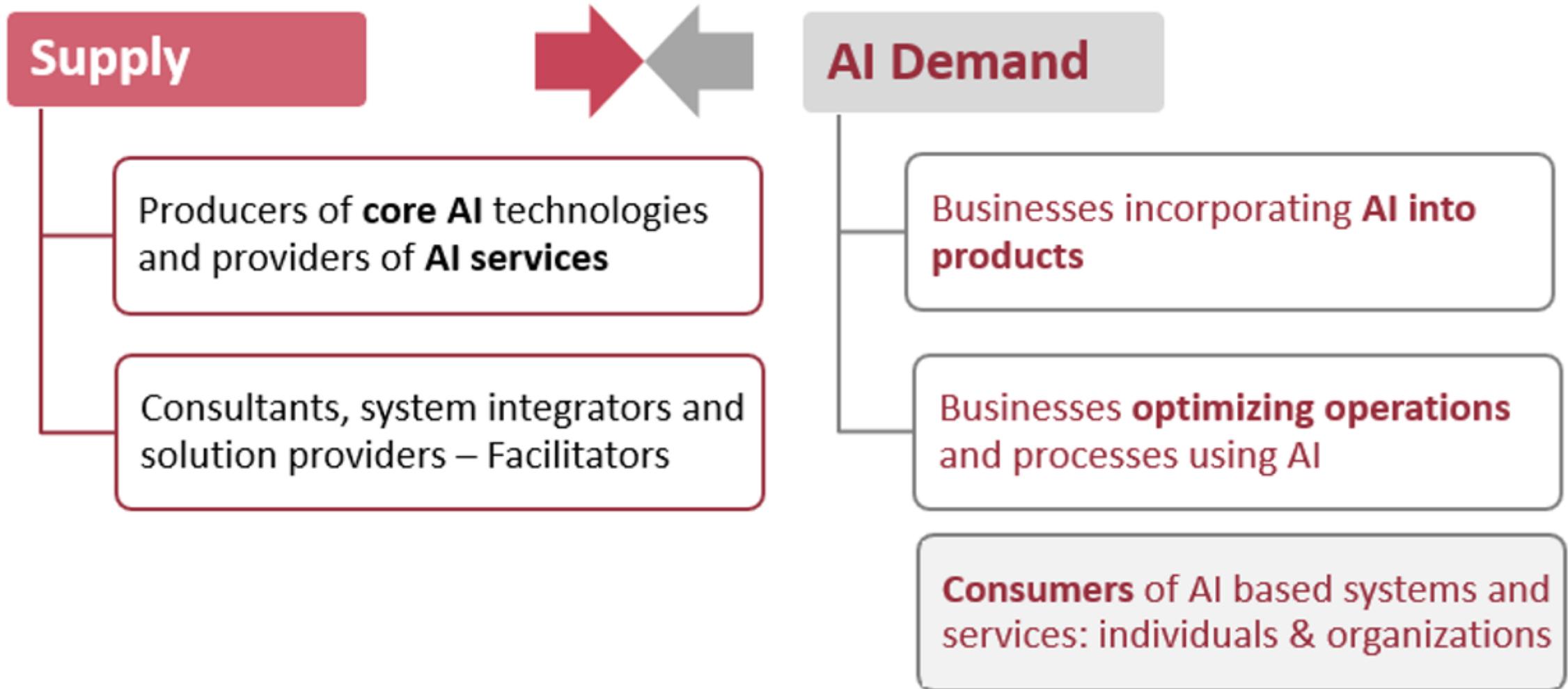
Deep Genomics

DEEP GENOMICS
FINDING BETTER CANDIDATES FOR DEVELOPMENTAL DRUGS

<https://builtin.com/artificial-intelligence/artificial-intelligence->



AI-powered, Fully Automated Products | Cruncho



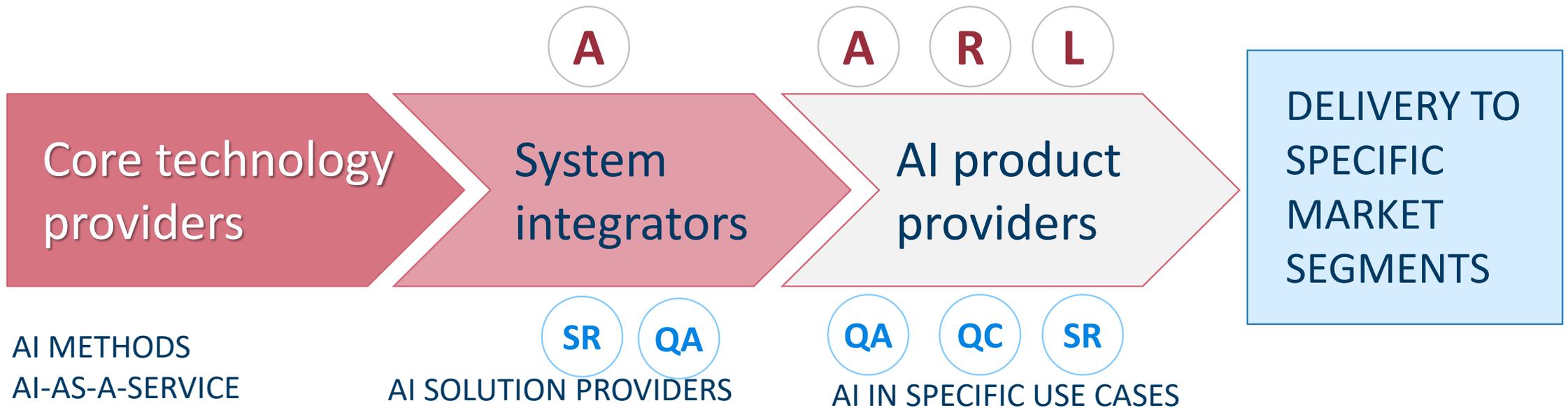
- System reliability (SR)
- Quality assurance (QA)
- Quality control (QC)

- Accountability (A)
- Responsibility (R)
- Liability (L)



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ACCOUNTABILITY

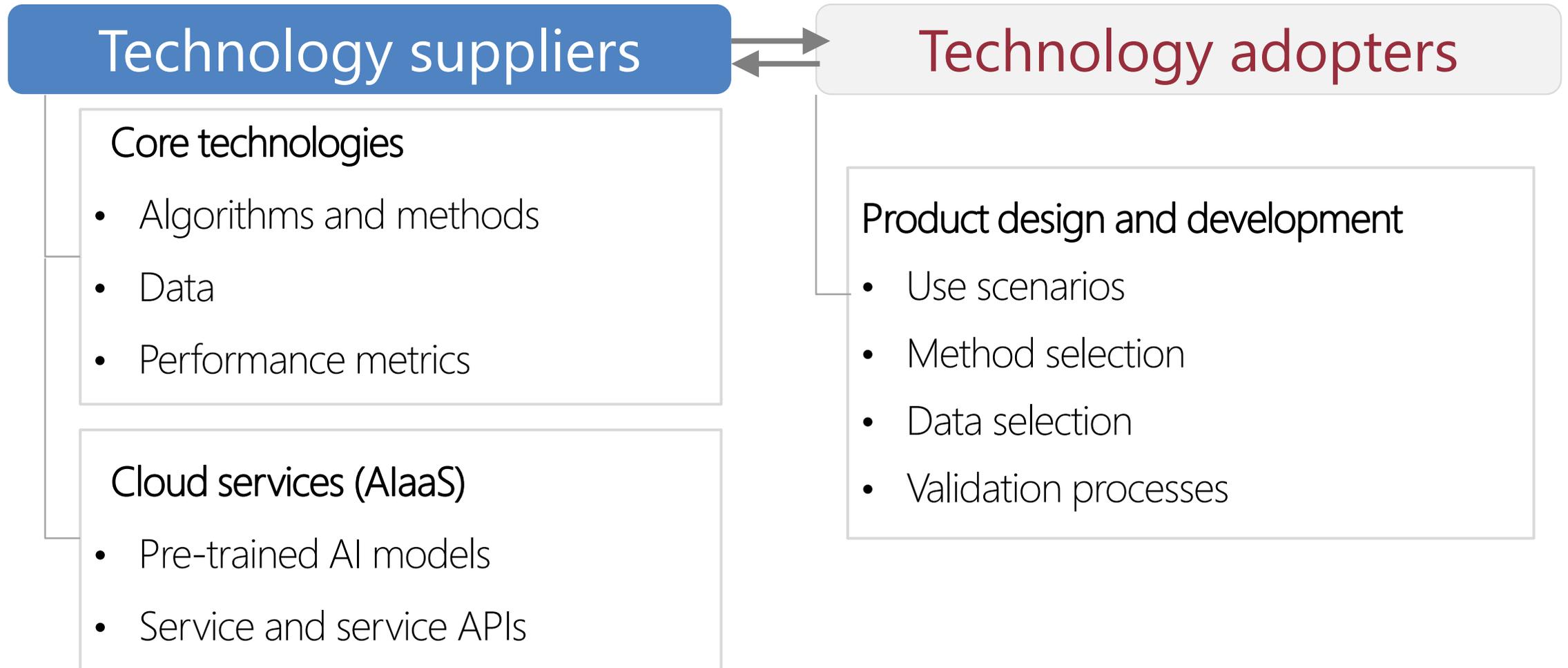
- Accountability is answerability – one is compelled to or called to account for one's action
- Applies to **all those involved** in a specific action
- Assessed **from the nature of an action** and the relationship of the person to the action's outcome.

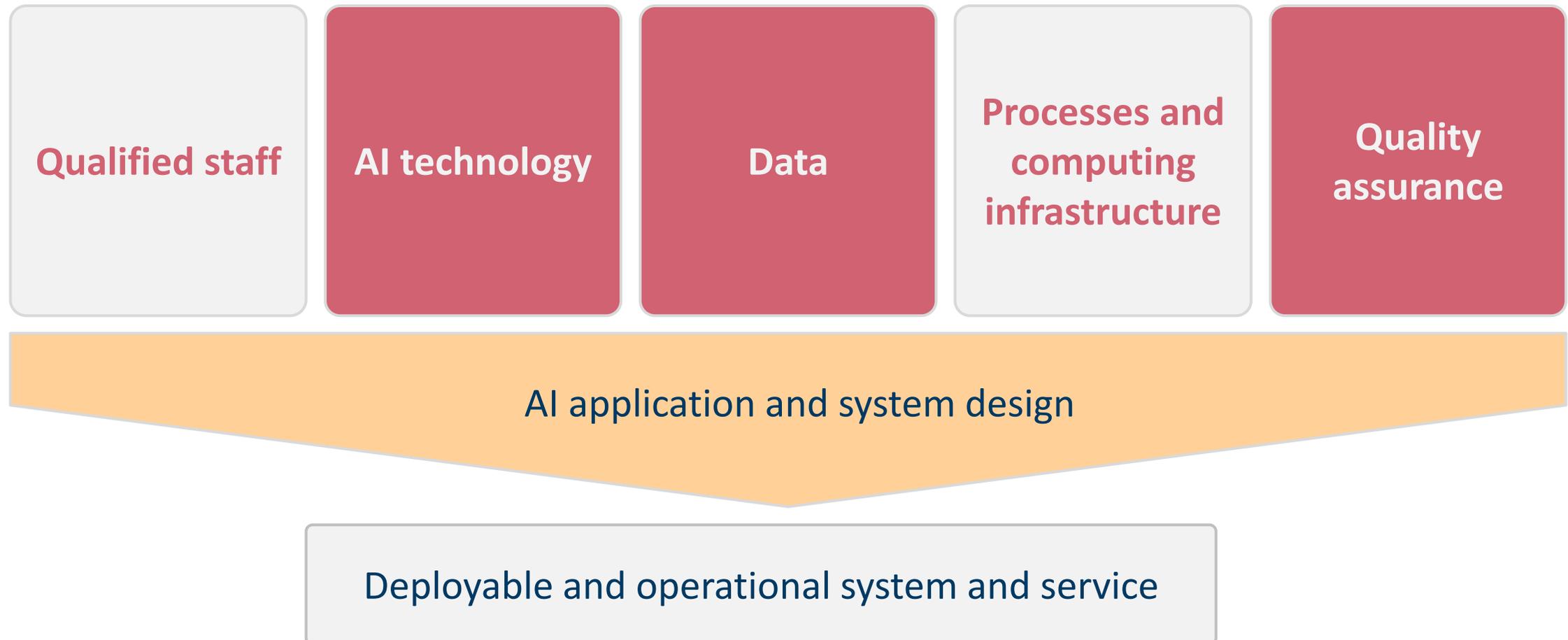
MORAL RESPONSIBILITY

- One's **voluntary actions** have **morally significant outcomes** that would make it appropriate to blame or praise them
- Assessed by establishing a link between a person and someone or something that is **affected by the actions** of the person.

LIABILITY

- Liability is focused on a **person who is to blame** and needs to **compensate victims** for damages suffered after the event
- Liability is rooted in the **suffering of victims**
- The starting point for assessing liability is the victim's condition.





Google Cloud Platform

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CLOUD VISION API FEATURES

Derive insight from images with our powerful Cloud Vision API

- Label Detection**
Detect broad sets of categories within an image, ranging from modes of transportation to animals.
- Explicit Content Detection**
Detect explicit content like adult content or violent content within an image.
- Logo Detection**
Detect popular product logos within an image.
- Landmark Detection**
Detect popular natural and man-made structures within an image.
- Face Detection**
Detect multiple faces within an image, along with the associated key facial attributes like emotional state or wearing headwear. **Facial Recognition is not supported.**
- Image Attributes**
Detect general attributes of the image, such as dominant colors and appropriate crop hints.
- Web Detection**
Search the Internet for similar images.
- Integrated REST API**

Incorporating API calls into a program that can submit images to Google Vision to characterize objects in images.

```

11 if input("See additional features? ") == "yes":
12     print(faces)
13     pdb.set_trace()
14
15 def detect_labels(path):=
16 def detect_landmarks(path):=
17 def detect_objects(path):=
18 def detect_safe_search(path):=
19 def detect_web(path):=
20 def initialize_images():=
21
22 # Instantiates a service object (client) with your google application credentials
23 set_credentials()
24 # Credentials path = r"C:\Users\kooliv\Downloads\Python\Face_detection\1\YOUR_APP_ID_KEY_24
25 # os.environ['GOOGLE_APPLICATION_CREDENTIALS'] = credentials_

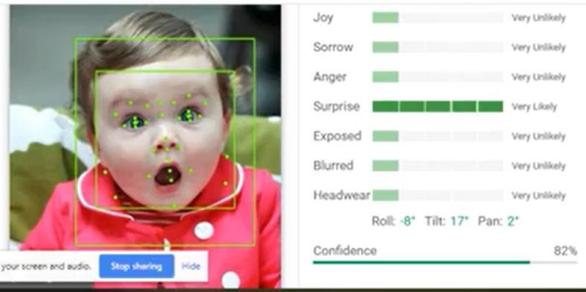
```

```

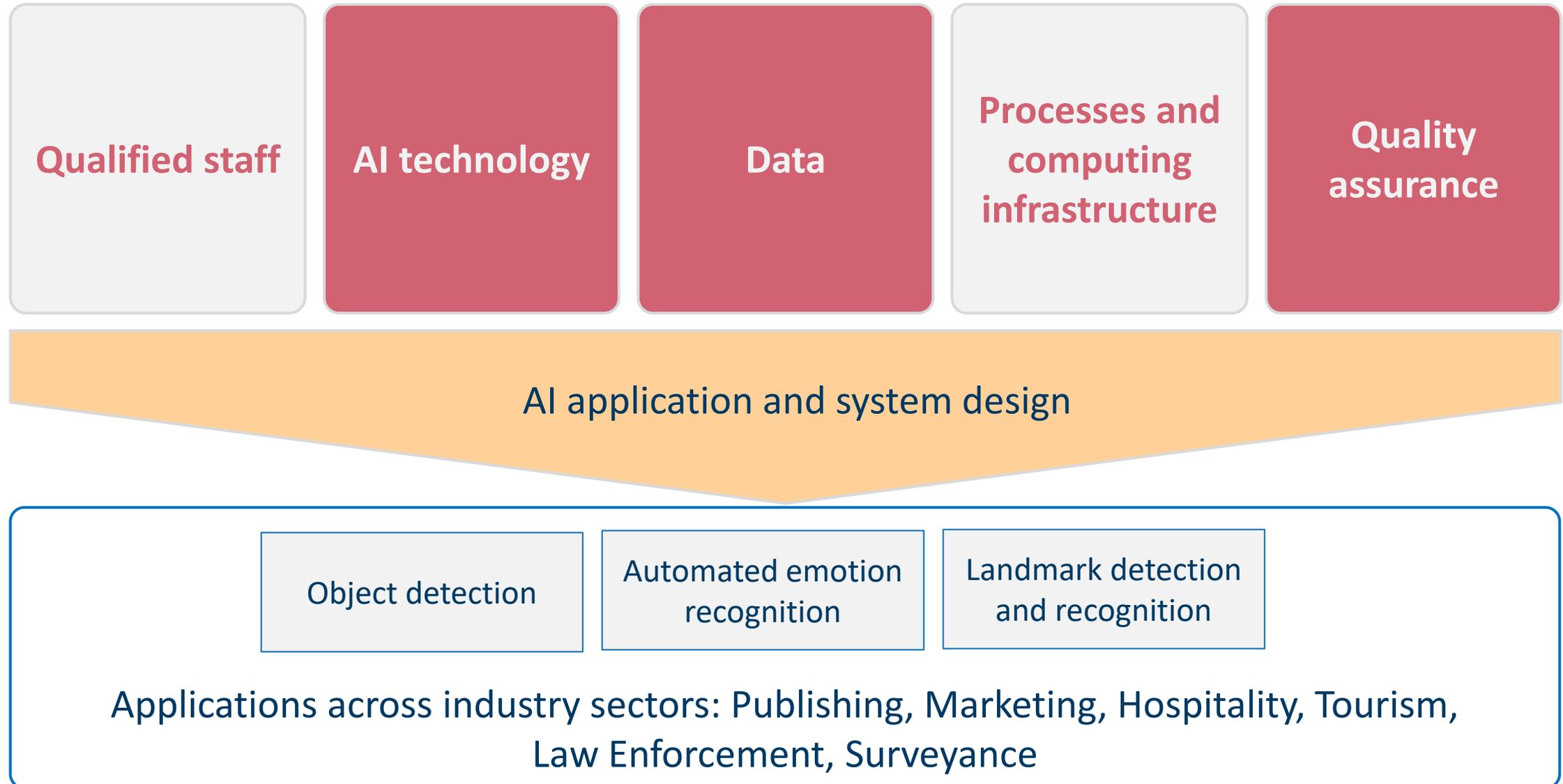
Detecting faces in file: rattlesnake_peak.jpg
Face detection confidence: 0.9999061226844788
[5]
Joy: VERY LIKELY
Surprise: VERY UNLIKELY
face bounds: ((132, 321), (188, 321), (188, 386), (132, 386))
See additional features? 1
Detecting faces in file: rattlesnake_peak.jpg
Face detection confidence: 0.9999041835810688
[5]
Joy: VERY LIKELY
Sorrow: VERY UNLIKELY
Anger: VERY UNLIKELY
Surprise: VERY UNLIKELY
Face detection confidence: 0.9999041835810688
[5]
Joy: VERY LIKELY
Sorrow: VERY UNLIKELY
Anger: VERY UNLIKELY
Surprise: VERY UNLIKELY
Press enter to continue to part 2...Traceback (most recent call last):
  File "C:\Users\kooliv\Downloads\Python\Face_detection\Face_2019.py", line 213, in <module>
    input("Press enter to continue to part 2...")
KeyboardInterrupt

C:\Users\kooliv\Downloads\Python\Face_detection\Face_2019.py
Detecting faces from url (input):
Enter image url:

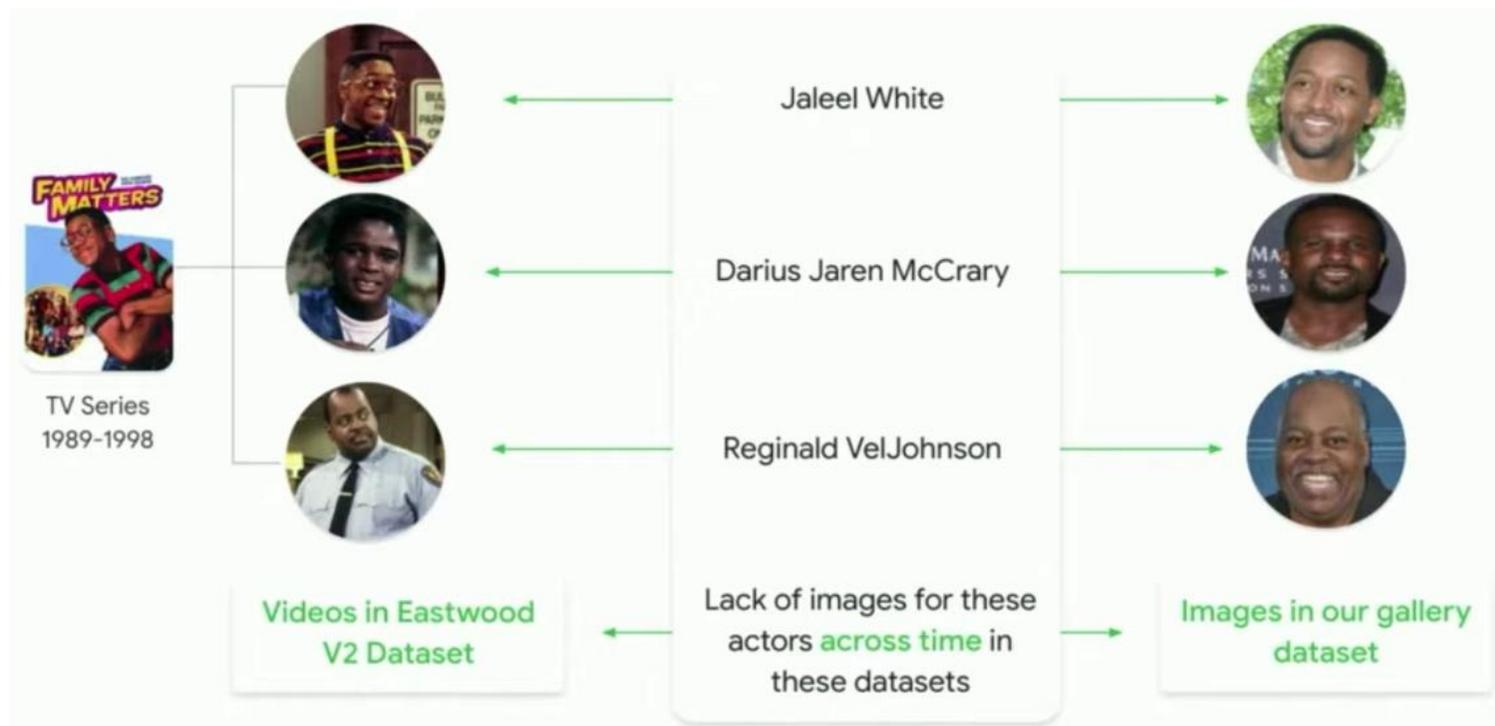
```



Attribute	Confidence	Label
Joy	Very Low	Very Unlikely
Sorrow	Very Low	Very Unlikely
Anger	Very Low	Very Unlikely
Surprise	High	Very Likely
Exposed	Very Low	Very Unlikely
Blurred	Very Low	Very Unlikely
Headwear	Very Low	Very Unlikely
Roll	-8°	
Tilt	17°	
Pan	2°	
Confidence	82%	



- Insufficient data to detect individuals as they age
- Generalization across data sets is a fundamental and well known problem in machine learning.



INCOMPATIBILITY OF TRAINING AND TEST DATA
 Training data did not have images of actors at different age.

- Not all the objects are equally represented in the databases.
- Problem of imbalanced classes is a well known machine learning problem.

Feature attribution highlights contributing factors

Counterfactual Test Results



Gun (/m/032rk): 0.956344

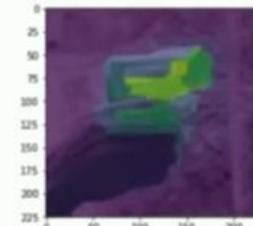


Hand (/m/0k65p): 0.972555
 Gun (/m/032rk): 0.953119
 Power tool (/m/0_ksk): 0.948796

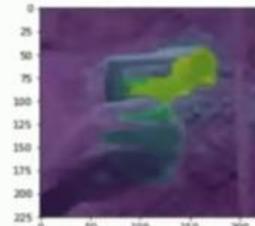


Power tool (/m/0_ksk): 0.959292
 Impact driver (/m/0c1zk9): 0.879339
 Gun (/m/032rk): 0.867835

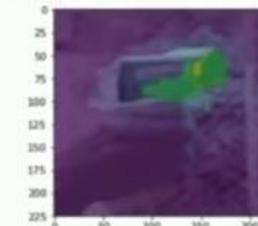
Saliency Maps



Explaining label: Gun (0.935581)



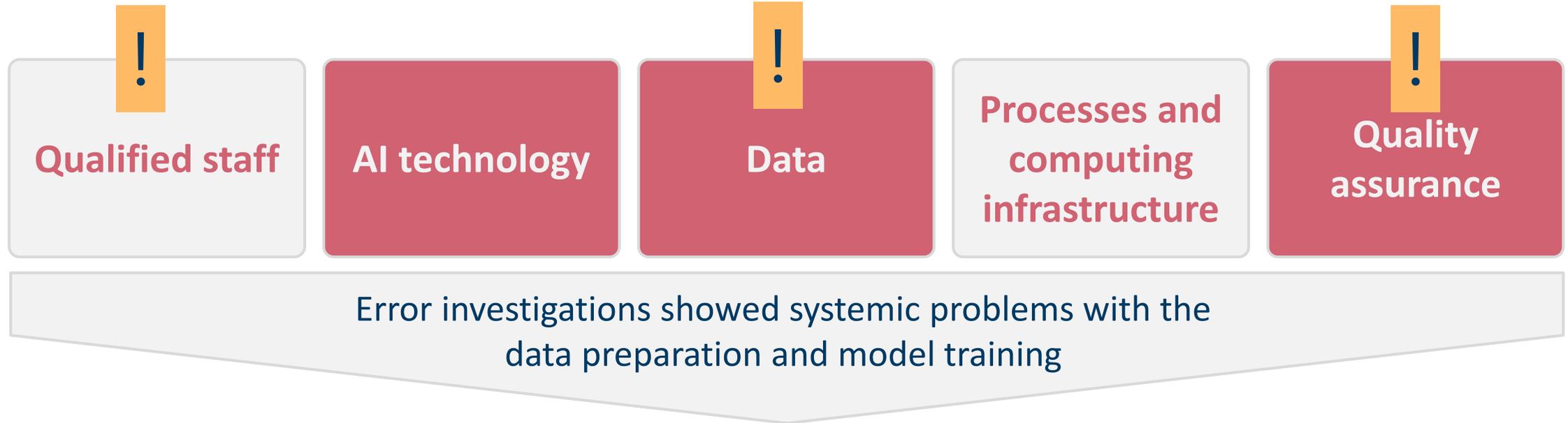
Explaining label: Gun (0.932645)



Explaining label: Gun (0.834837)

HIGHLY IMBALANCED REPRESENTATION OF OBJECTS IN DATA

Many more images of individuals with dark skin colour holding a gun than holding a thermometer. Generally very few images of hand-held thermometer.



AI Assurance: Quality evidence

Government interventions

Press release | 21 April 2021 | Brussels

Europe fit for the Digital Age: Commission proposes new rules and actions for excellence and trust in Artificial Intelligence

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The Commission proposes today new rules and actions aiming to turn Europe into the global hub for trustworthy Artificial Intelligence (AI). The combination of the first-ever [legal framework on AI](#) and a new [Coordinated Plan with Member States](#) will guarantee the safety and fundamental rights of people and businesses, while strengthening AI uptake, investment and innovation across the EU. New rules on [Machinery](#) will complement this approach by adapting safety rules to increase users' trust in the new, versatile generation of products.

"The combination of the first-ever legal framework on AI and a new Coordinated Plan with Member States will guarantee the safety and fundamental rights of people and businesses"

[Europe fit for the Digital Age: Artificial Intelligence \(europa.eu\)](#)

21 APRIL 2021

Independent report

The roadmap to an effective AI assurance ecosystem

Published 8 December 2021

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Ministerial foreword

Artificial intelligence (AI) is one of the game-changing developments of the 21st century. From powering innovative businesses of all sizes across the length and breadth of the UK, to enabling trailblazing research into some of the greatest societal challenges of our time, AI offers a world of transformative potential. As AI becomes an increasingly important driver of economic and social progress, we need our governance to keep up. Getting governance right will create the trust that will drive AI to unlock its full potential. As we announced in the National AI Strategy, the Government will establish [‘the most trusted and pro-innovation system for AI governance](#)

“The UK intends to establish the most trusted and pro-innovation system for AI governance in the world”

[The roadmap to an effective AI assurance ecosystem - GOV.UK \(www.gov.uk\)](#)
8 DECEMBER 2021

The roadmap to an effective AI assurance ecosystem

Artificial intelligence (AI) offers transformative opportunities for the economy and society, but these benefits will only be realised if **organisations, users and citizens can trust AI systems and how they are used.**

The roadmap to an effective AI assurance ecosystem - GOV.UK (www.gov.uk)

AI assurance provides the tools to build trust and ensure trustworthy adoption

Assurance is about building confidence or trust in something, for example a system or process, documentation, a product or an organisation.

Assurance services help people to gain confidence in AI systems by evaluating and communicating reliable evidence about their trustworthiness.

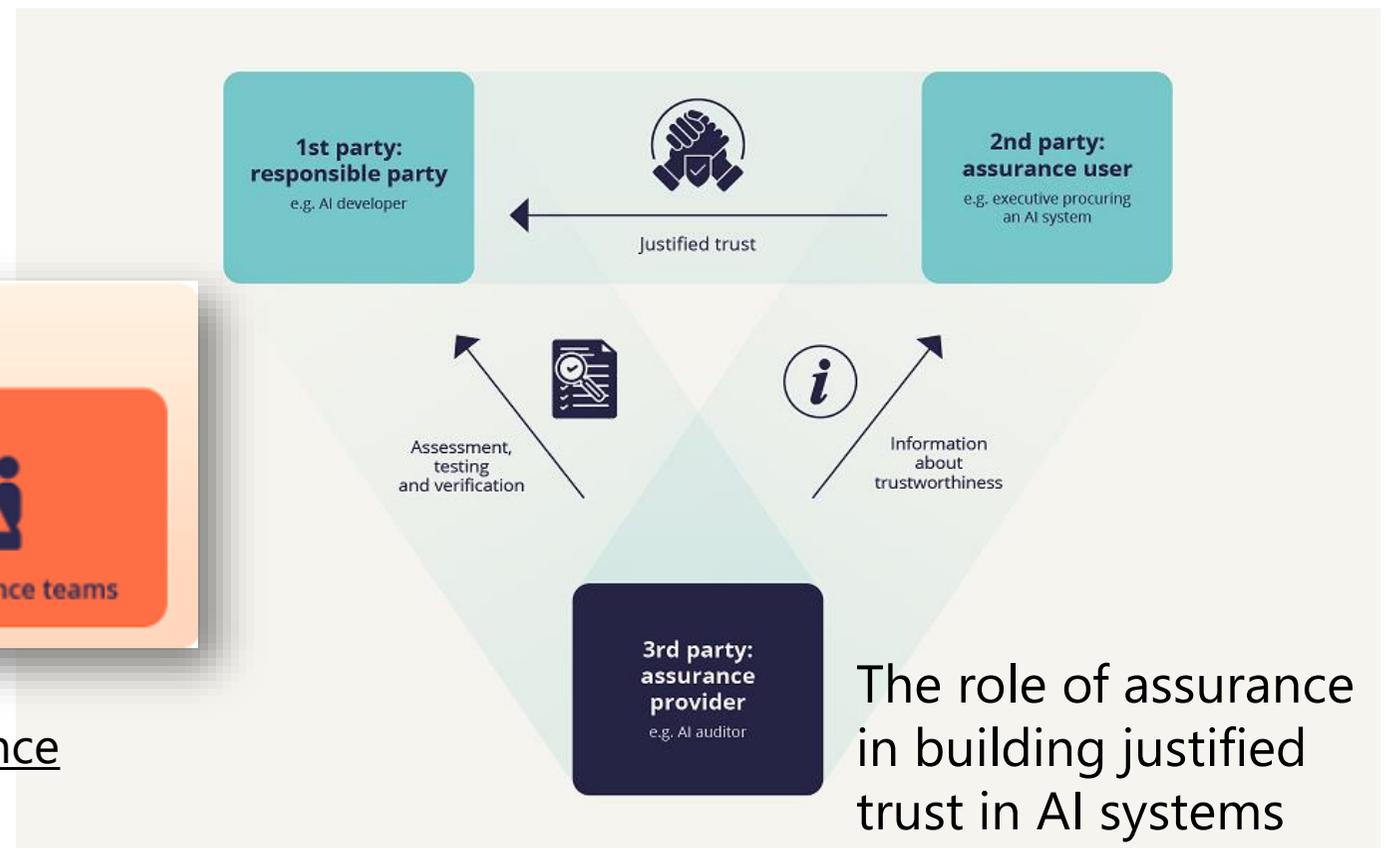
To provide meaningful and reliable assurance for AI, organisations need to overcome:

- An **information problem**: **reliably evaluate evidence** to assess whether an AI system is trustworthy.
- A **communication problem**: communicate the evidence at the right level, to inform assurance users' views on whether to trust an AI system.

[The roadmap to an effective AI assurance ecosystem - GOV.UK \(www.gov.uk\)](https://www.gov.uk)



Mechanisms for assuring AI systems



The role of assurance in building justified trust in AI systems

[The roadmap to an effective AI assurance ecosystem - GOV.UK \(www.gov.uk\)](https://www.gov.uk)



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Thank you!

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Exercise:

1. Select an ML/Data Science project.
2. Provide a list of requirements for reproducibility of the computational set up and the experiments.