# A Conversation on AI

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# Overview

- About us
- What is AI & What can it do?
- Will AI take our jobs?
- Warnings (limits of AI)
- Ethics

R&D

&

R&D

# Recent Highlights

Applied Artificial Intelligence Institute

**Applied Artificial Intelligence Institute**

# Recent Project Partners

# Trauma Reception & Resuscitation

A.I. | Digital Health | Optimisation

✅ 21% reduction in errors of omission

✅ 30% reduction in blood transfusions

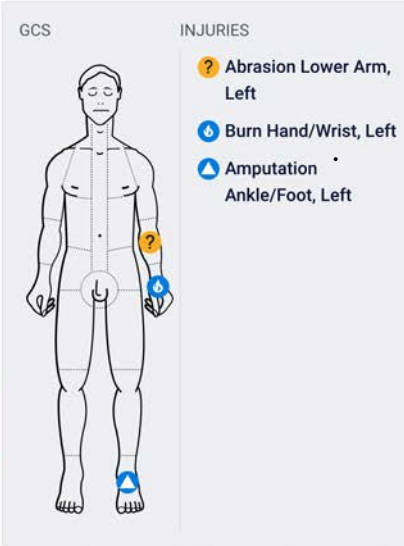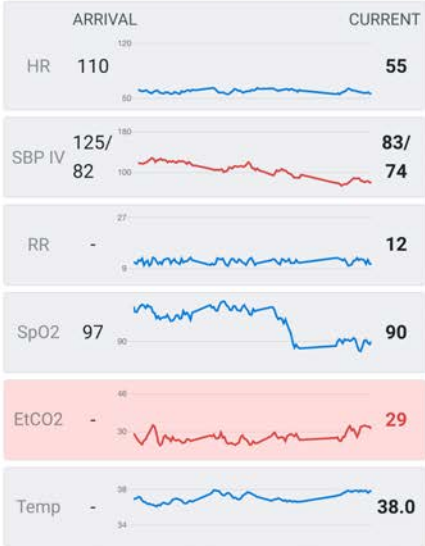✅ Significantly reduced the time of patients spent in I.C.U.

Deakin University, 2019

# Decision Support in the trauma ward (currently active)



| Wed - 27 Nov - 11:13 | Time Since Arrival 00:31 |
|---|---|
| **Bloggs** Joe | |
| **MRN** | |
| 01/01/1972 | 47 yrs | 70 kg | Male |

MOTOR VEHICLE, DRIVER, NO SEAT BELT W...
THROWN FROM VEHICLE
ALL **PENICILLIN**
UNKNOWN MEDICAL HISTORY

Timeout - Life-Saving Interventions
Tourniquet
Is there Spinal Cord Injury?

|  | ARRIVAL | CURRENT |
|---|---|---|
| HR | 110 | 55 |
| SBP IV | 125/82 | 83/74 |
| RR | - | 12 |
| SpO2 | 97 | 90 |
| EtCO2 | - | 29 |
| Temp | | 38.0 |

GCS  INJURIES

- Abrasion Lower Arm, Left
- Burn Hand/Wrist, Left
- Amputation Ankle/Foot, Left

DRUG AND FLUID TOTAL
10:58  Morphine  10 mg
10:58  Normal Saline  200 mls

TREATMENTS
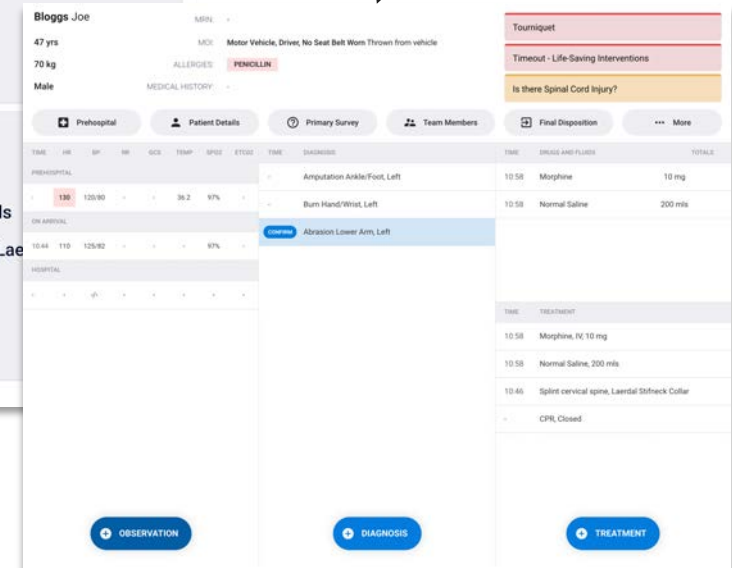10:58  Morphine, IV, 10 mg
10:58  Normal Saline, 200 mls
10:46  Splint cervical spine, Lae... Collar
-  CPR, Closed

Copyright © Alfred Health Victoria 2019

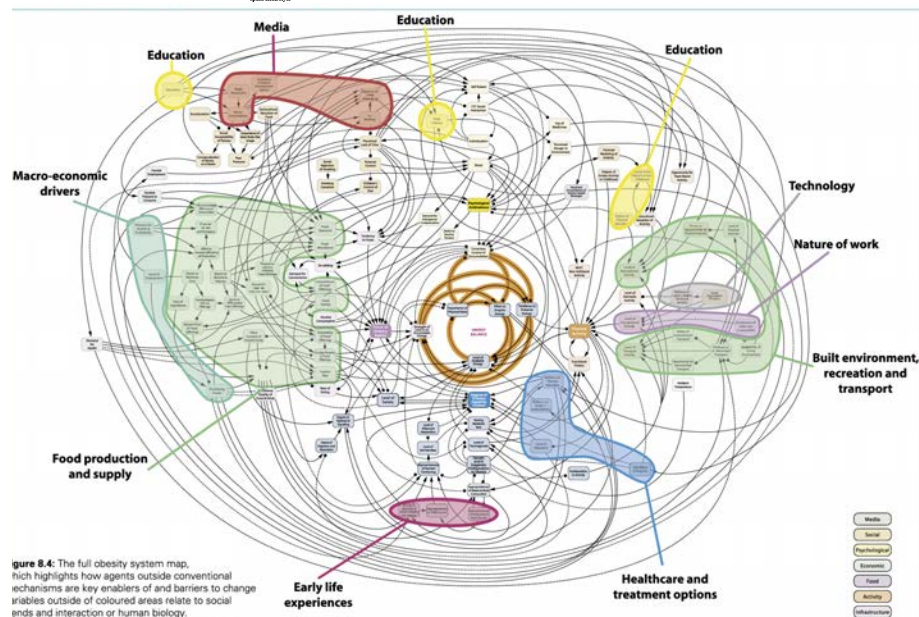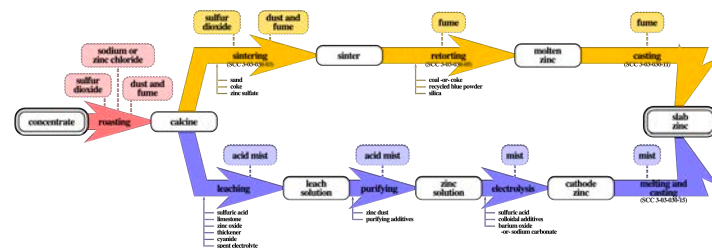**Nurse/Scribe  (Data entry)**

**Common view (TV/Remote)**

# Adaptive Experiment Design (Finding optimal steps towards a goal)



What combination of steps & mixtures should we follow to get a desired clinical outcome?

What treatment (intervention) provides the best result for a population? (can we personalise these?)

Can I incrementally find better strategies to get an outcome? (RCT is too slow!!)



Figure 8.4: The full obesity system map, which highlights how agents outside conventional mechanisms are key enablers of and barriers to change variables outside of coloured areas relate to social trends and interaction or human biology.

# Smart homes



📅 Platform uses **IoT sensors** placed throughout the house to **monitor motion**.

🔔 **Escalates alerts** to enable carers to investigate out of norm activity.
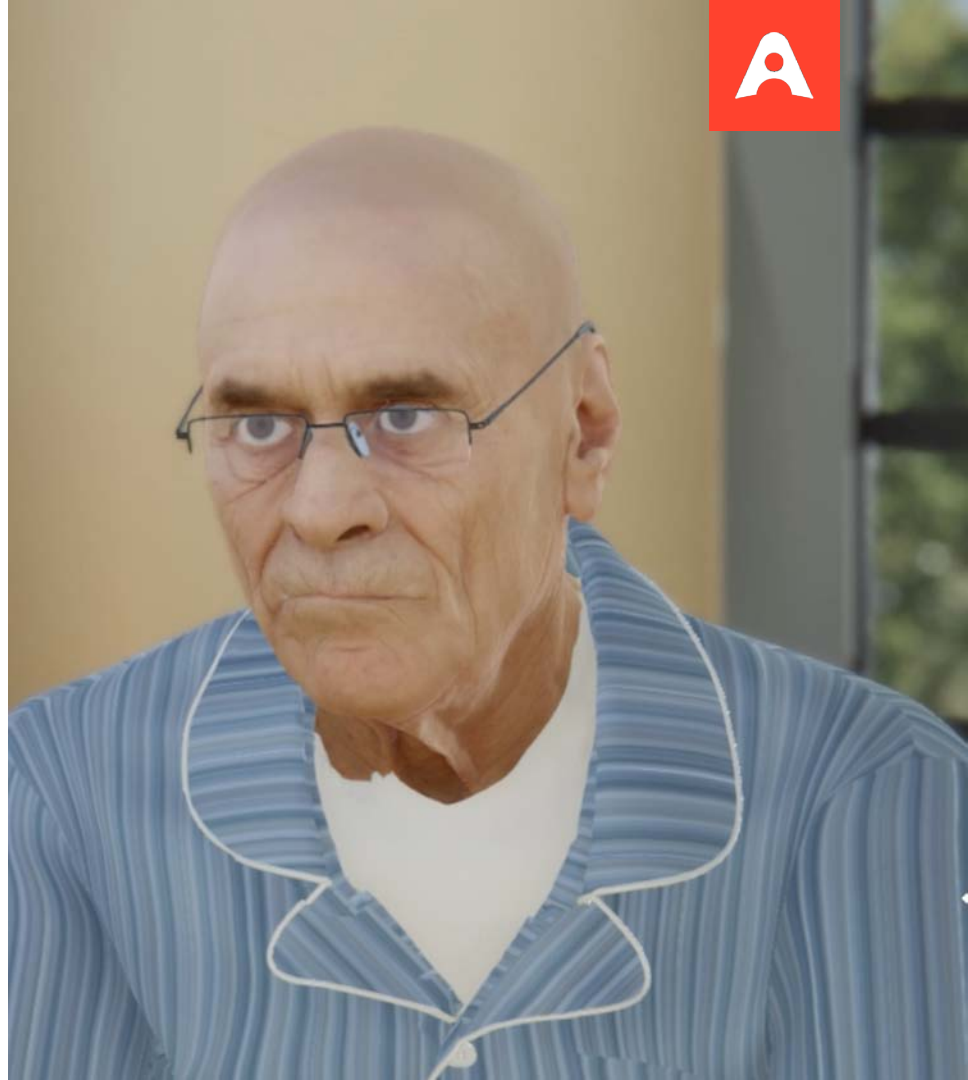
# Training with an Avatar

Language understanding  |  Conversation Generation

Early results show significantly stronger recall of training compared to paper.

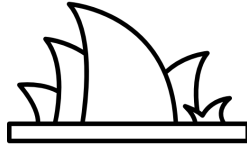For some tasks, training with synthetic avatar worked better than when done with a human actor.

Highly cost-effective & we can continuously improve and adapt the avatar.

Deakin University, 2019
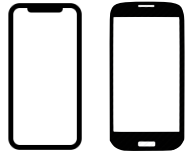
# Scalable Experimentation Platform

Scalable

Data in Australia

Secure and anonymous by design
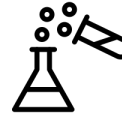
Can Ingest diverse datasets

Support uploads from iOS and Android & Web

Extensible & Support different ML/AI Analysis methods

Can be used by multiple institutes (multi-tenanted)

Supports multiple concurrent experiments



**Currently rolling out to support 20k students /mental health (4 year longitudinal study)**

# Surgery or meds?

NLP  |  Machine Learning (Classification)
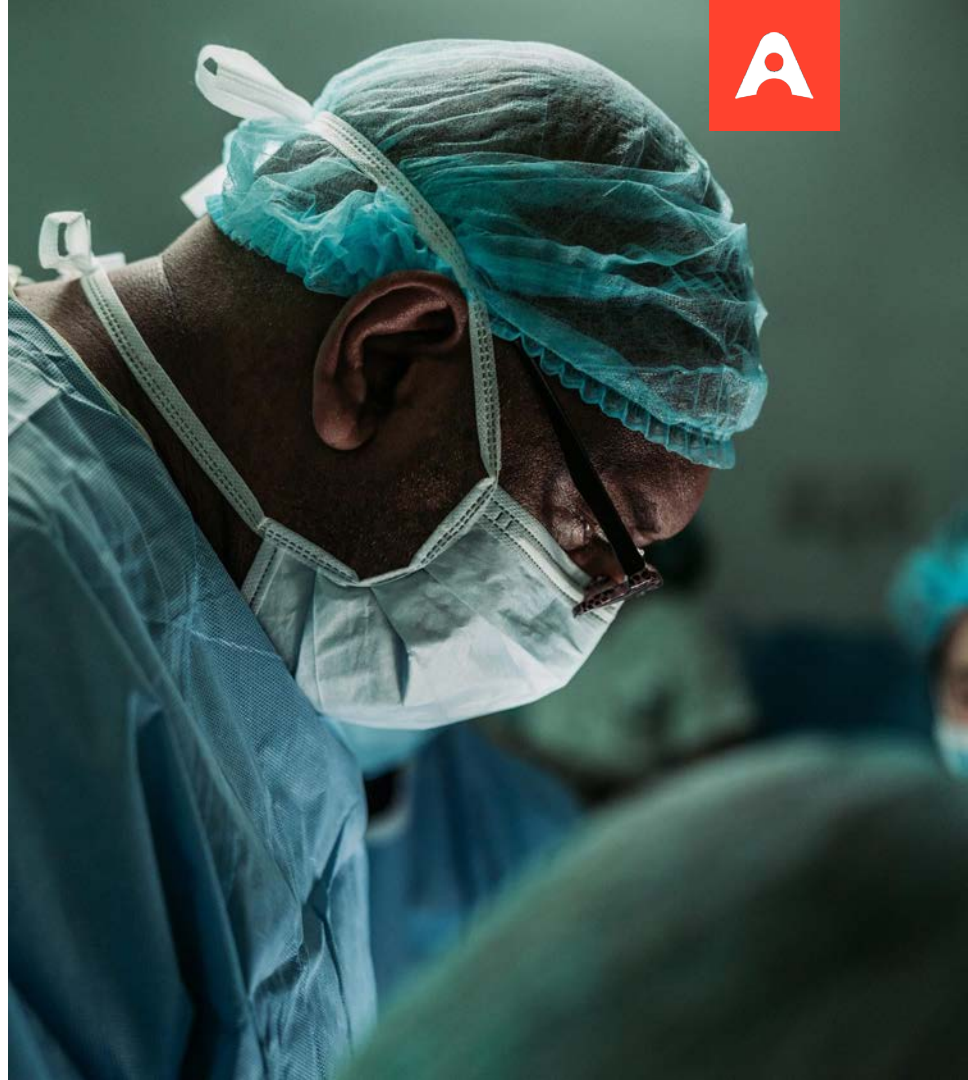
**Applied Artificial Intelligence Institute**

# What is AI?

AI is "A system that has the **appearance** of **intelligence** which aids a **human** in the completion of a task"

Effective AI systems are very heavily reliant on a **human in the loop**.
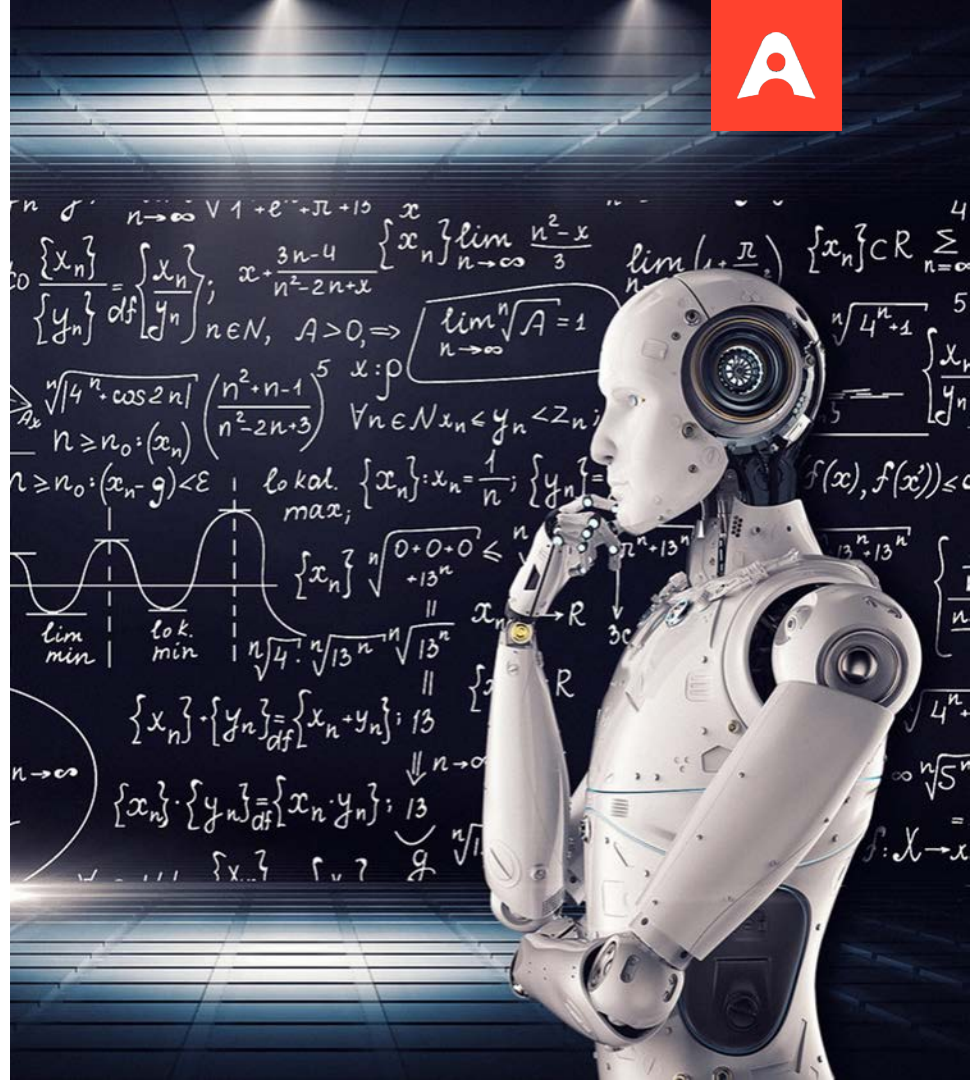
Given a stable domain & sufficient data,
the algorithms to find patterns are mature

# Power of AI (~ 2019)



## Image Generation

Image generated by an AI
**www.thispersondoesnotexist.com**

This is state-of-art in pattern generation (machines are moving beyond pattern detection & forecasting)

**What can AI do?**

- **Predict** (based on some past data)
- **Classify** (Categorize) information
- Learn **behavior** (via reinforcement)
- **Search / Optimize** (complex spaces, multiple dimensions)
- Decide/**Act** using rules (fixed or probabilistic)

**Knowledge comes from humans**

- Vision system **classifies** objects in the scene (at some <u>confidence</u>)
- Lane **prediction** (plus short-term simulation of future at some <u>confidence</u>)
- Driving **behavior** (learnt using historical driver behavior on same road)
- **Optimize** sensor data and actuators (to some <u>confidence</u> interval)
- **Search** map for path & track
- Use **rules** to ensure within speed limit + estimate collision probability



A Self-driving car's AI
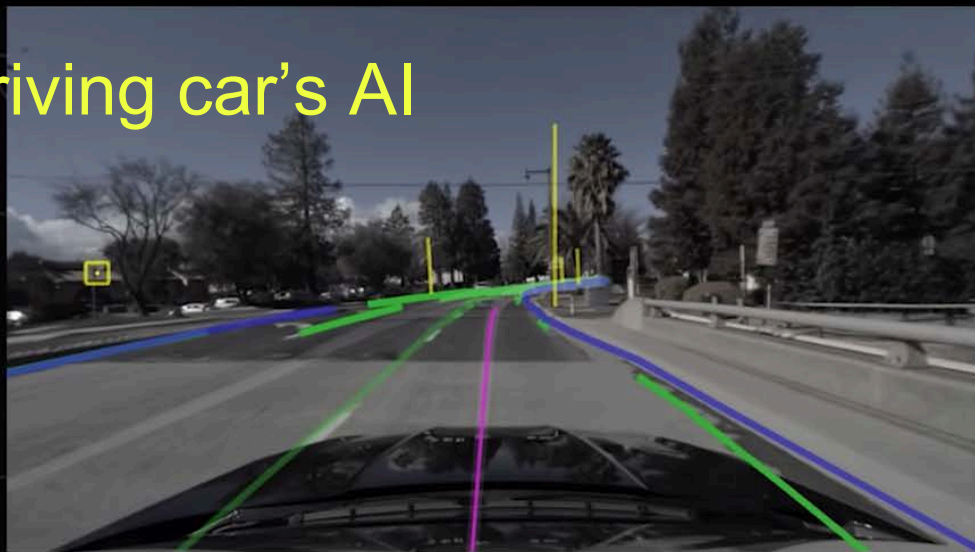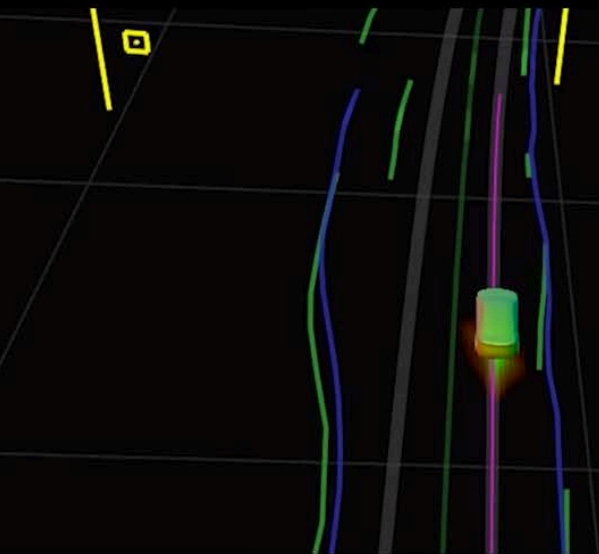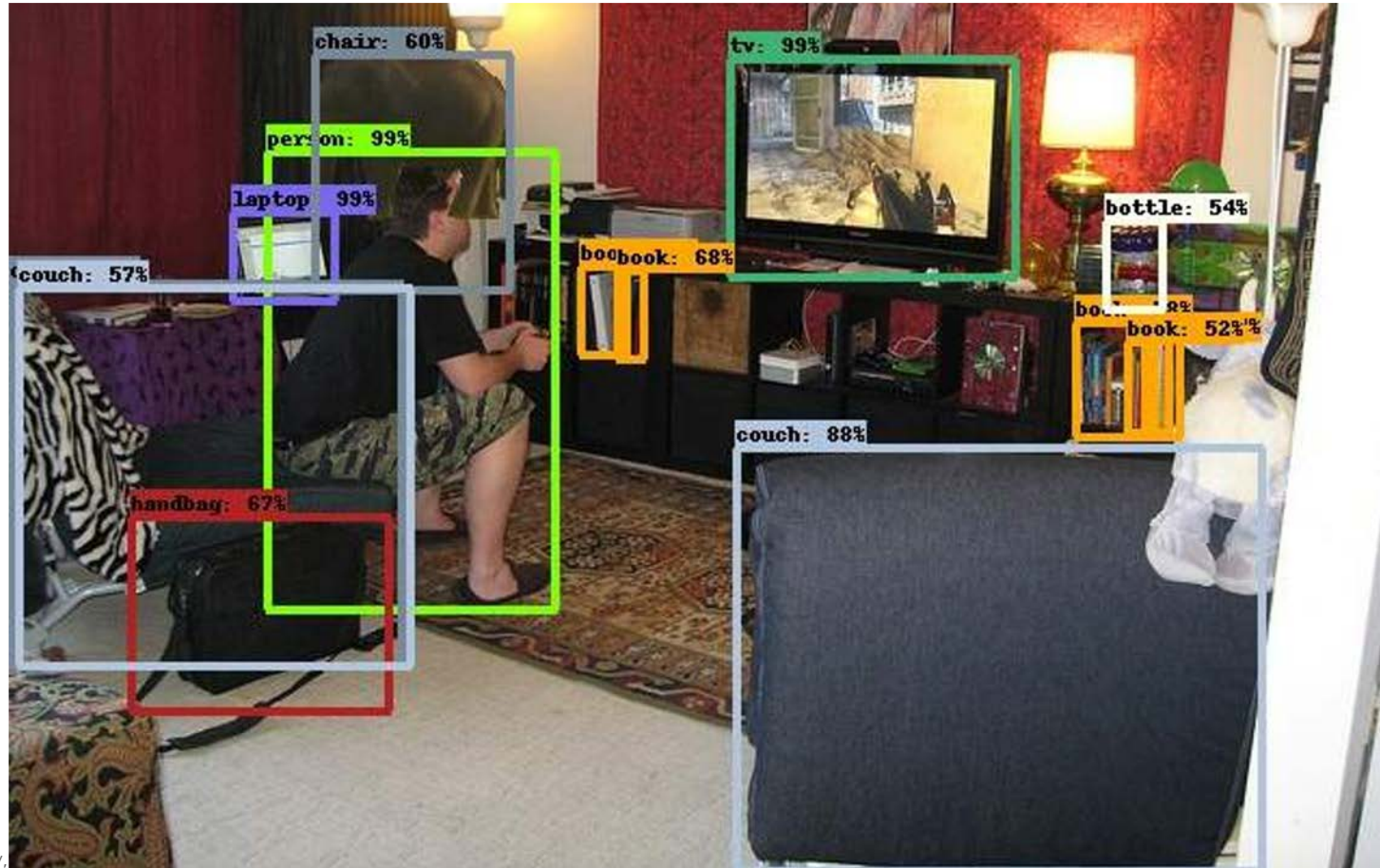
# Will AI take all of our jobs?

- Short answer = not ALL jobs
- Highly repetitive, transactional work is at risk

    - Most current AI is narrow in scope

    - Works well for pattern matching & pattern generation
- Current methods **do not** deal well with edge-cases
- **Evaluation** of probabilistic systems is **hard** (limits use cases)

# Example - The elephant in the room (~ 2018)

# How can we evaluate below?

**Text generated from an initial lead line (~ 2019 state of art)**

"Cooking rice and beans by steaming a roast in a wok is easy! Just follow these 40 simple steps to update your XBox firmware, and you'll end up with a nice fried soup"

"Comedians fear the looming resolution of a long-running comedian feud. Also, Soviet spectators at the Munich Olympics cheer Yuri Gagarin, who, although escorted by Russian soldiers, uses rockets and airplanes in his Olympic performances to win multiple medals. The crowd of Soviet spectators, "[l]argely composed of high school students in tight-fitting vacant uniforms [...] walked away believing that Gagarin was the next North America's greatest athlete"

# Warnings (it is not magic & has limits)

AI techniques scale/speed up humans – **pick tasks that humans can verify**

Be honest about why you want AI *(Learning, marketing, provable value)*

Data alone is not enough. **Need subject matter experts** & quality data.

Need different methodology for AI – it is not typical software development

**Failure** (of AI) **is a first-class citizen** - must deal with it in all parts are workflow

Utility & value of AI systems can only be properly determined in the real-world

Total cost of ownership is high for AI

**Evaluation is hard** -- not easy to know if it works till you use it (in production)

# EMR Context – Areas to consider for research

- Data in EMR systems is often not perfect -> need **methods to improve this at capture?**
- Highest quality data is data captured for billing -> **How much of this is useful?**
- What is the most critical data we need to add into EMR? -> **Data Valuation**
- How can we **merge expert (tacit) knowledge with empirical** data?
- Detecting changes & alerting on anomalies → **Decision aid value**
- Solutions that reduce workforce load, while improving outcomes (**workflow fitness**)

# Challenges

- Most current data not collected for AI/ML & historical data may not be useful
- Multiple systems (duplication, inconsistencies)
- Socio-technical (politics, economics, change management)
- AI/ML techniques fit easily to stable domains (stationary, independent, identically distributed), not all health fits this.
- Evaluation is non trivial with AI/ML – How do you know the AI is right?

# Other possible areas to consider

- Communicating machine's insights to humans better
- AI to help improve education (personalised)
- Automation of repeatable/transactional tasks (designed, intentional)
- Smarter reports (search and surface information in context)
- Collaborative monitoring (use machines to help us find what is worth monitoring)
- Data valuation (and alerting on poor data quality / hide information that has less value in a context)


- Note: Pattern recognition (cancer on image) or case summarisation intentionally omitted -- we need evaluation, communication and trust here (see above)

# AI Ethics Principles

- **AI must generate benefits**
- **Safety, protection and harm minimization by design**
- **Commitment to good governance**
- **Privacy & Security by design**
- **Respect & Dignity (Fairness)**
- **Understandable transparency & interpretability**
- **Contestability**
- **Accountability**

**- Verification of principles can only be done by humans -**