NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

# ‘The Future of Artificial Intelligence (AI)’

## Promise & Reality

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# ROADMAP

1. AI past
2. AI future
3. AI Now, Reality & Promises
4. Opportunities, Pitfalls & Challenges
5. Core Pillars to Sustainable Artificial Intelligence

# AI past

# Artificial Intelligence Evolution

Alan Turing

John McCarthy

Frank Rosenblatt

Was there much excitment ?

**1950**

**Turing Test**

proposed Test as **measure of machine intelligence**

**1956**

**AI Born**

organizes 1st conference & coins **Artificial Intelligence**

**1957**

**Perceptron**

invents the **Perceptron**

“within ten years a digital computer will be the world's chess champion," and, "within ten years a digital computer will discover and prove an important new mathematical theorem.”

Herb Simon

American Economist and Political Scientist

Allen Newell, 1958

American Computer Scientist

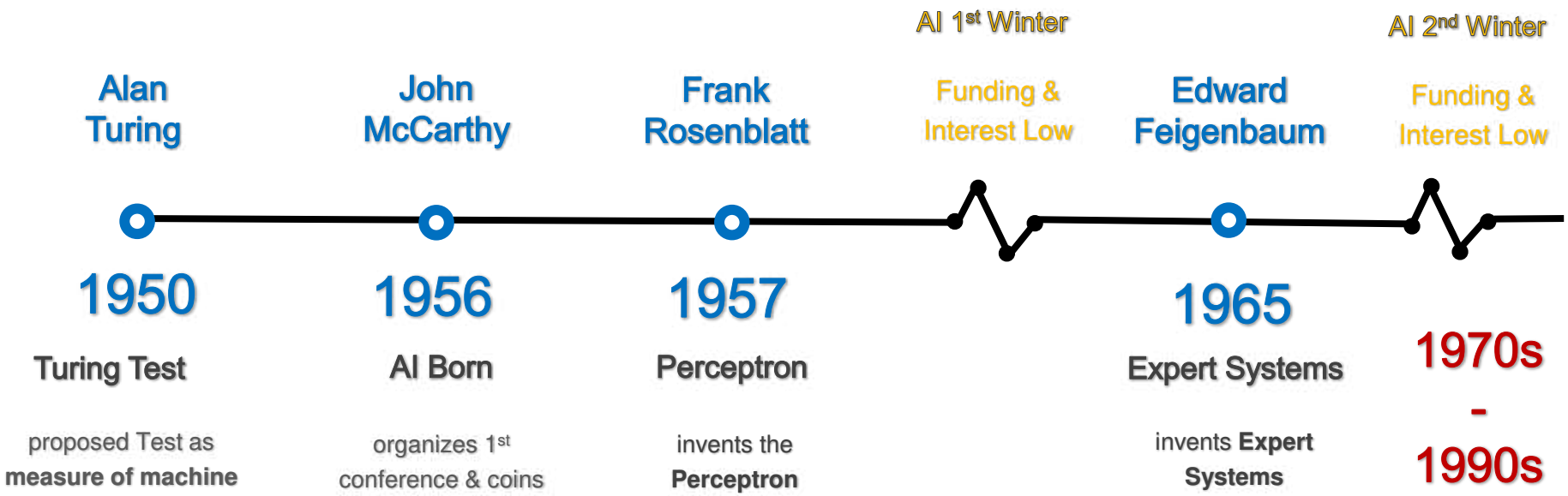
"Within our lifetime machines may surpass us in general intelligence"

"Within a generation, I am convinced, few compartments of intellect will remain outside the machine's realm – the problem of creating 'artificial intelligence' will be substantially solved"

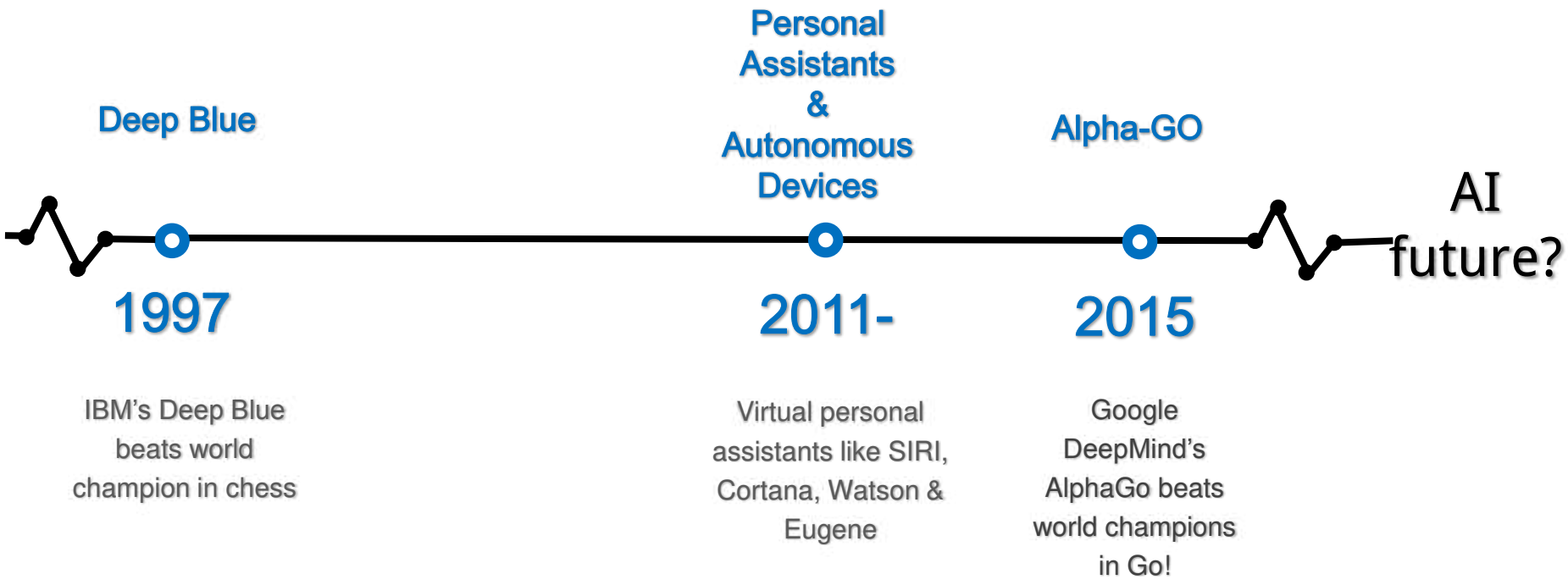
Marvin Minsky, 1960s

American Cognitive Scientist

# Artificial Intelligence Evolution



# Artificial Intelligence Evolution



Many spectacular predictions of the AI future…

“Artificial intelligence will reach human levels by around 2029.”

Ray Kurzweil, 2014

Inventor and Futurist

“Computers will overtake humans with AI within the next 100 years.”

Stephen Hawking, 2015

Theoretical Physicist and Cosmologist

“Probably closer to 2030 to 2040 imo. 2060 would be a linear extrapolation, but progress is exponential.”

Elon Musks’ Twitter, 2017

CEO, SpaceX

How about those Experts that '*makes/creates'* Artificial Intelligence, what would they say?

Question: "When will AI Exceed Human Performance?"

## WHEN WILL AI EXCEED HUMAN PERFORMANCE?

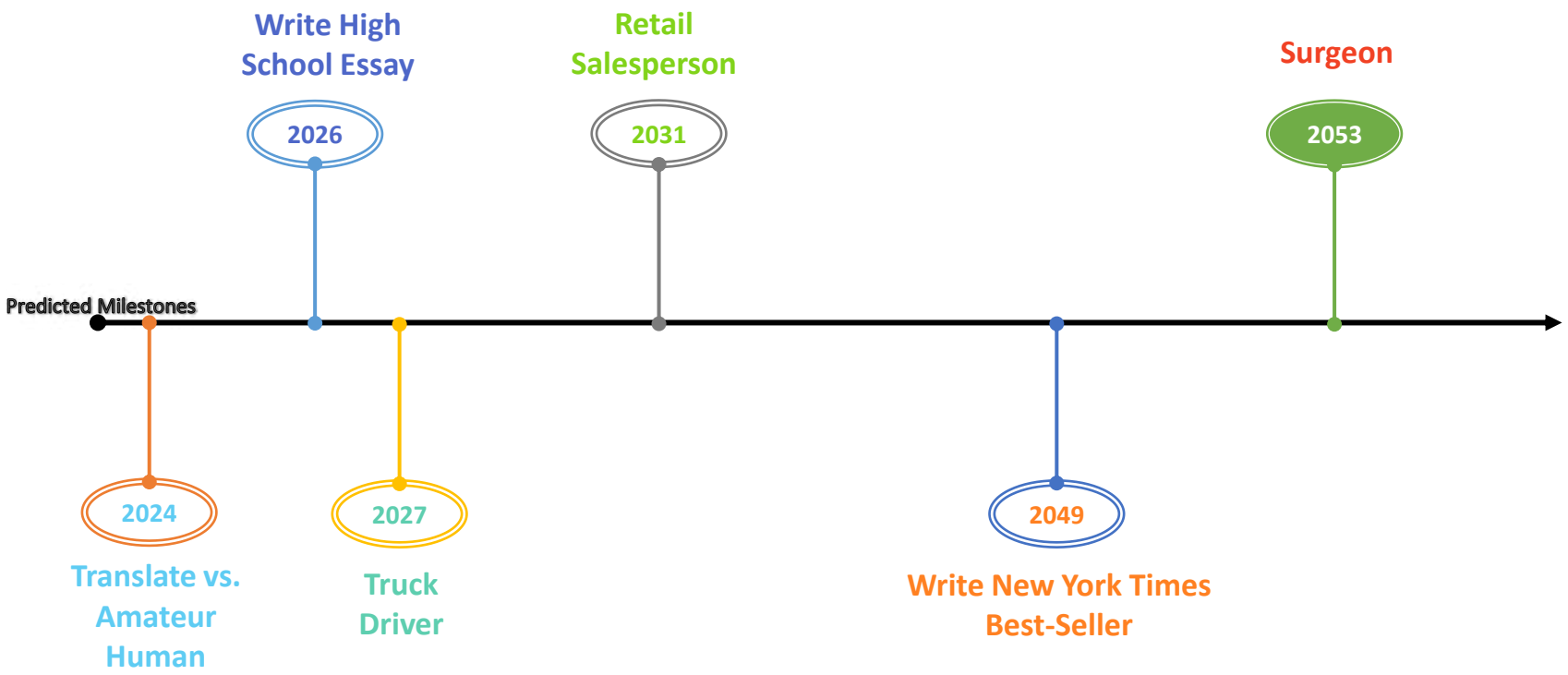
AI outperforming humans in all tasks in **45 years**

AI automating all human jobs in **120 years**

Evidence By 252 AI experts
(people who *makes* AI), 2016

Statistics from Publication: "When Will AI Exceed Human Performance? Evidence from AI Experts"

# AI WILL EXCEED HUMAN PERFORMANCE AT…




Statistics from "When Will AI Exceed Human Performance? Evidence from AI Experts"

Seen the past…

Heard the future…

**Where do we go from here?**

“Learn from the past, Prepare for the future, Live in the present”

Thomas S. Monson

# AI now

What's Reality…

"*Machines* are excellent & reliable in numbers."

*"27834729847.333*
**x**
*847389875497 = ?"*

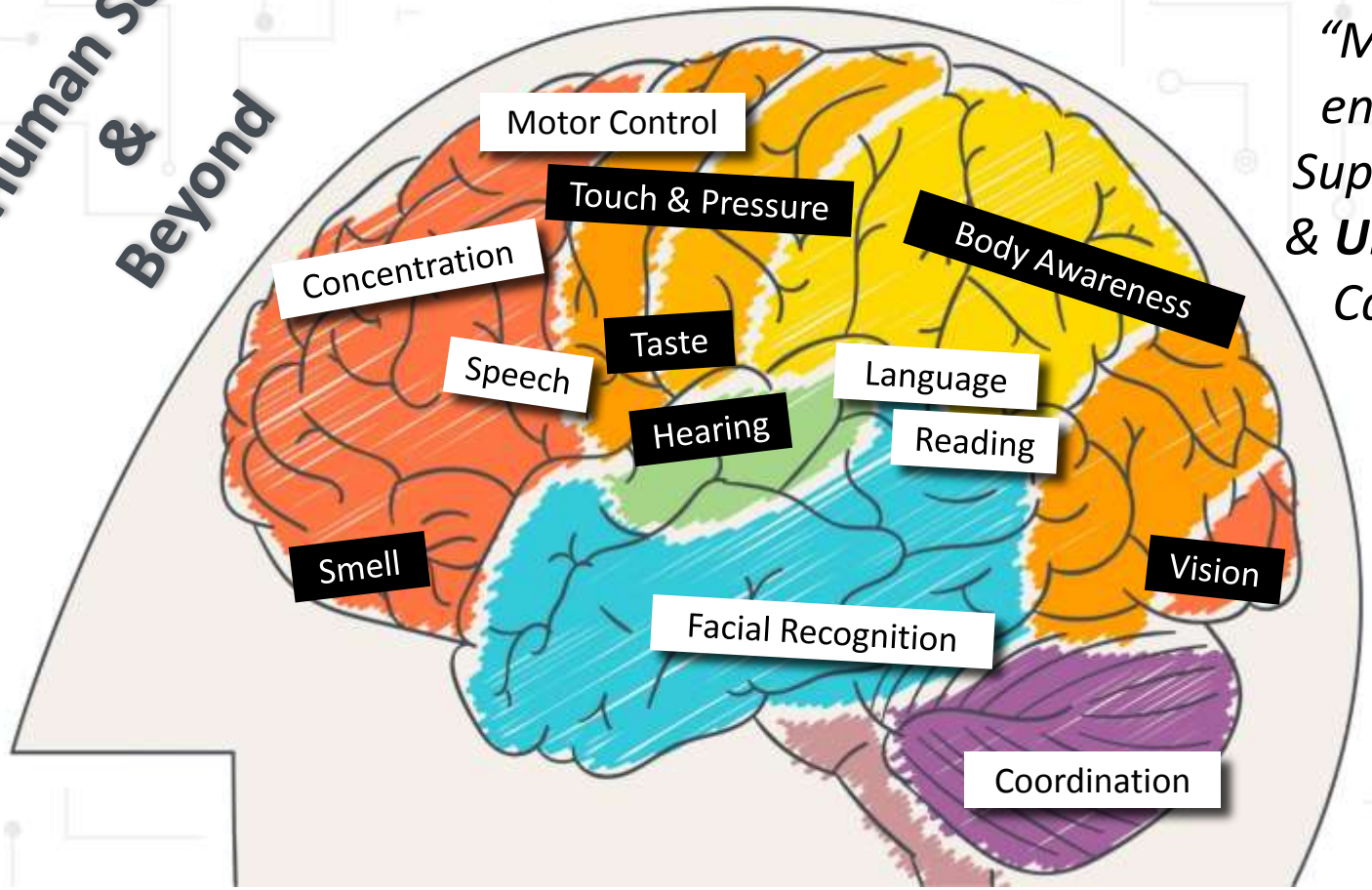
"Can *Machines* look at you & understand your emotional state*?"*

"AI has by now succeeded in doing essentially everything that requires 'thinking' but has failed to do most of what people and animals do 'without thinking"

Donald Knuth, 2009
American computer scientist

# The Reality…

Basic Human Senses & Beyond




*"Machines are endowed with Super AI **Sensing** & **Understanding** Capabilities."*

# AI now

`UNDERSTAND'
&
`SMART DECISIONS'

SENSES GOING BEYOND HUMAN SPECTRUM

SIGHT HEARING

SPEECH SMELL …

GOES BEYOND BIOLOGICAL SPECTRUM…

Augmented Intelligence

GOES BEYOND TRADITIONAL OBJECT…

# The Promises…

# AI Opportunities…

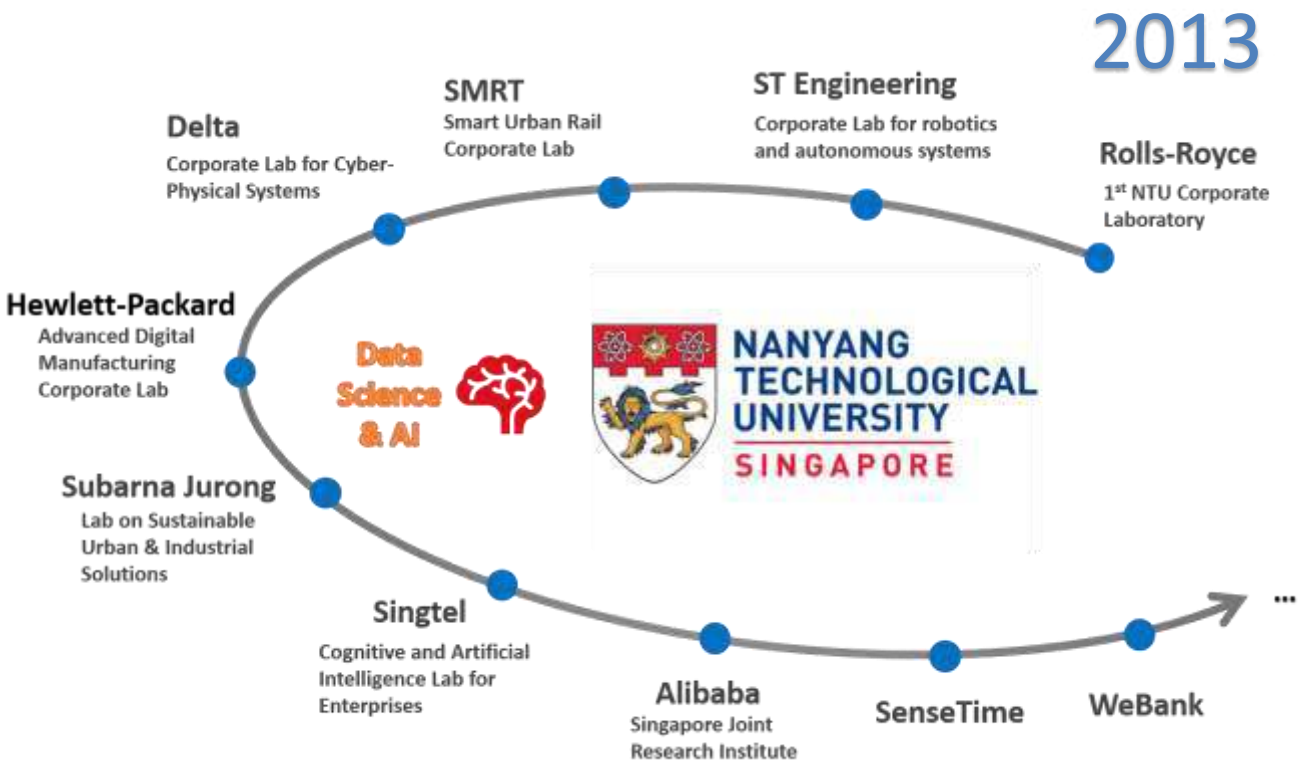
# AI @ NTU

## Companies are embarking on DS & AI initiatives

ICT, Services

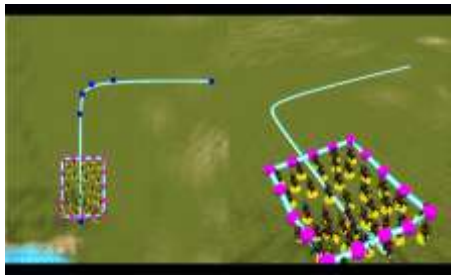
Traditional Industry

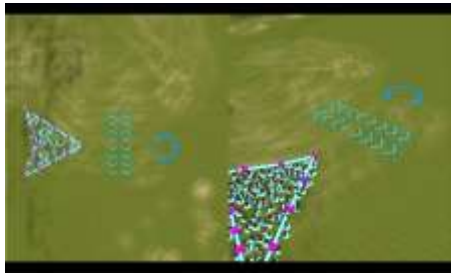
New Business



# AI Low-hanging fruits

**Early Artificial Intelligence Activities @ NTU**





**Crowd AI IP created in 2008**

"… funded by the National Research Fund, launched **Dark Dot on Apple iTunes app store in October 2011. Shortly after its launch, it became the top action game in 48 countries, including United States, China and Singapore and** beat popular apps and games such as Facebook, What's App, Angry Birds and Bejeweled! With a **download of well over 448,000 players worldwide**, with 27% of its players from China and 17% from the USA." – 2011

We set you thinking
TODAY

**"DarkDot"**

**Inzen Studio Pte. Ltd. Startup** that raises $717,288

Acquisition by iCandy Interactive Limited for $4.4m

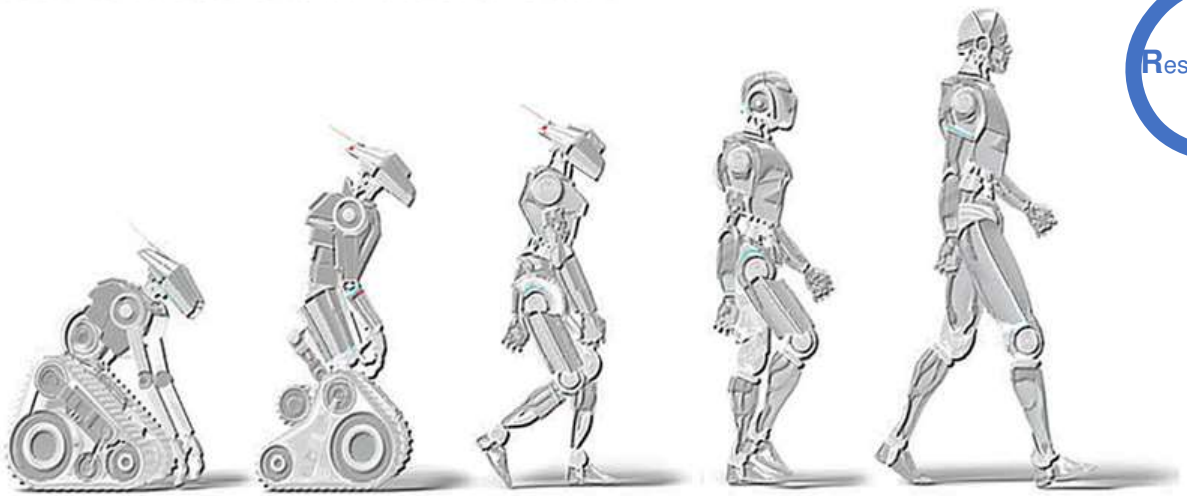
# AI Pitfalls & Challenges

Sustainable Artificial Intelligence…

# Artificial Intelligence $R_5$

## $AIR_5$

*5 Core Pillars to address Pitfalls for Sustainable Artificial Life*



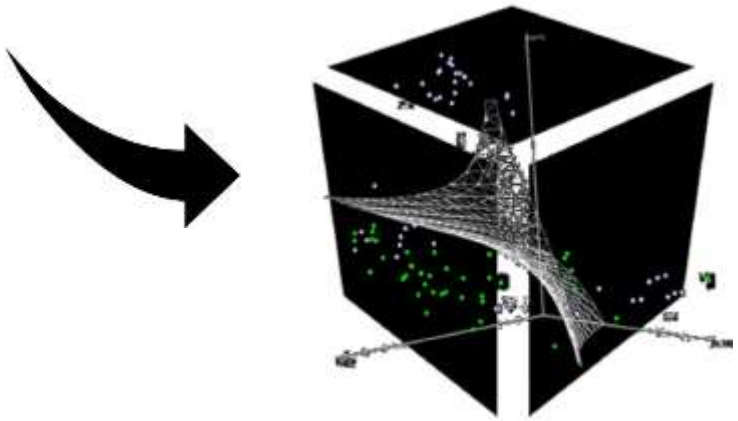
Accountability

Safety Critical

Quantify
Confidence

Input

spurious patterns



Output

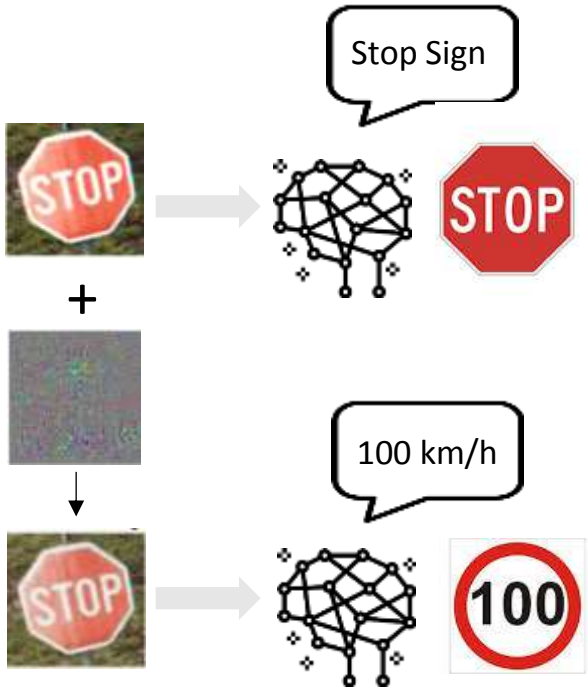
Explainable

Interpretable

Black box

# Rationalizability

Vulnerable




malicious data

adversarial attacks

# Resilience

Low Replications of
AI Promises

Formal Testing
& Verifications

AI Standards

AI Trustworthiness

# Reproducibility

**Specialized
AIs**

**Artificial
General Intelli**

Building ethics into AI

Privacy

National security

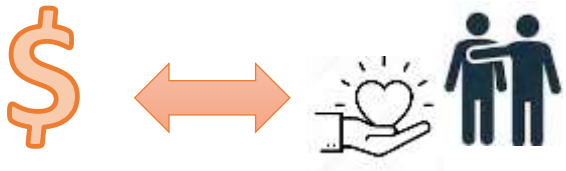
Public policy

# Responsibility

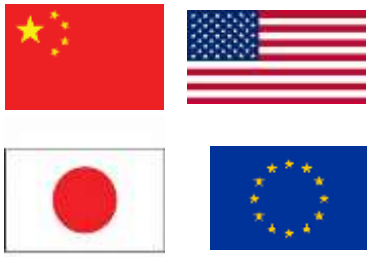
# What Does AI means to you?

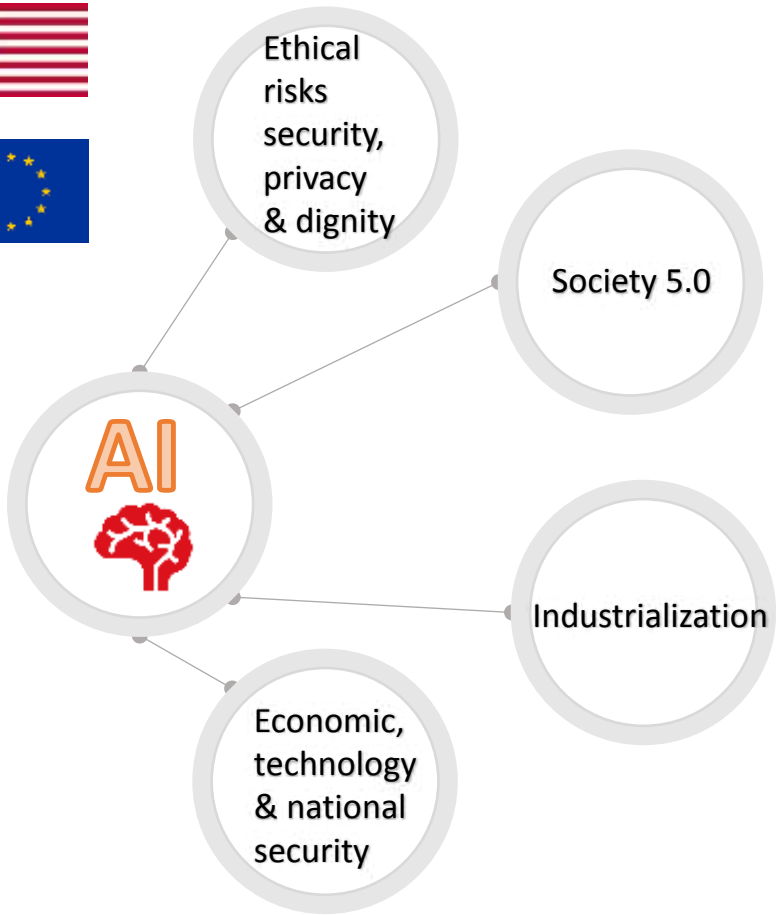
Full Automation

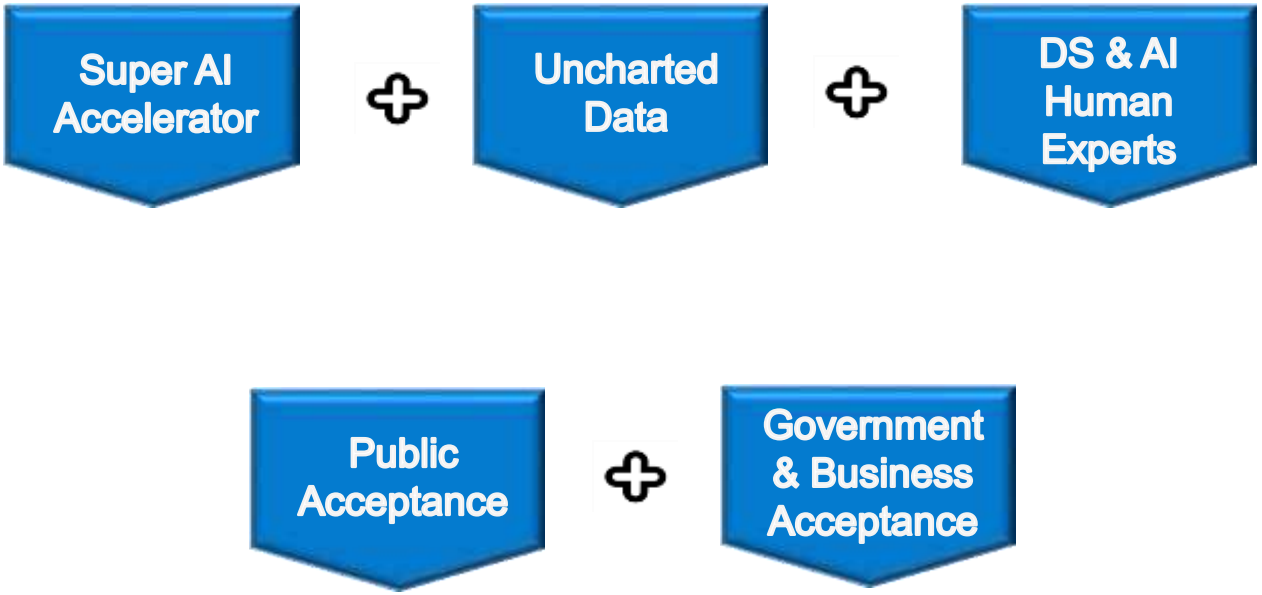
Humanizing AI



**Realism**





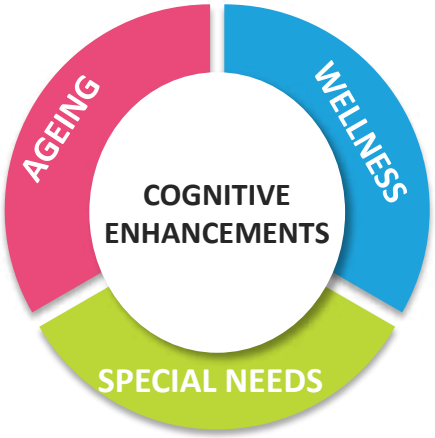

Super AI Accelerator
Uncharted Data
DS & AI Human Experts
Public Acceptance
Government & Business Acceptance

The future

# NOT FORGETTING…

## AI for Human Good

*Emotion Coaching and Regulation in Children with Autism Spectrum Disorders*



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Robot 1: http://bienvenuechezlydie.centerblog.net/2643-cadeau-3-pour-louis007
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