AI for Environmental Sustainability

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Dr Jou has published over 100 technical papers and reports, and 3 patents, and has translated 2 books He has been involved in many research projects since he joined the Department in 2004 and has received significant amount of research grant from various sources, including the National Science Council, Chung Shan Institute of Science Technology, Industry Technology Research Institute, Chung Yuan Christian University, and companies from the Industry

Education:

- Ph.D. in Integrate (ME, IE) Engineering, Ohio University, USA
- Master of Mechanical Engineering, Ohio University, USA

Research Interest:

Virtual Reality and Ergonomics, Design of Innovative Human Machine Interfaces, New Product Design, Smart Manufacturing, Machine Learning, Data Analysis

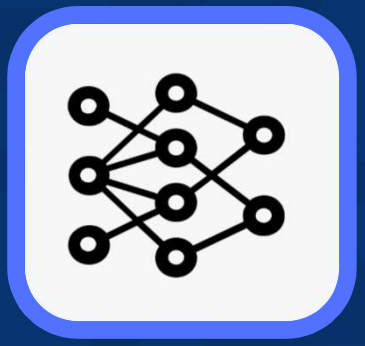
Work Experience (1998~2004):

- Salutron Inc. Fremont, CA, U.S.A., Sr. Mechanical & Manufacturing Engineer.
- New Focus Inc., San Jose, CA, U.S.A., Manufacturing & Mechanical
- Pantronix Corp., Fremont, CA, U.S.A., Sr. Mechanical Engineer.
- Tsunami Visual Technologies Inc., Fremont, CA, U.S.A., Technical Staff.

Outline

1. Introduction

2. Environmental Pillar in SDGs

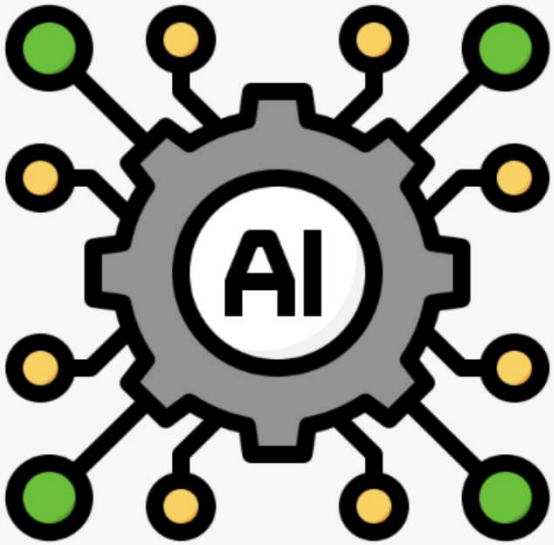


3. Current, Challenges, & Limitations of AI

4. Future Impact Perspective

5. Study Case (Taguchi & ANN)

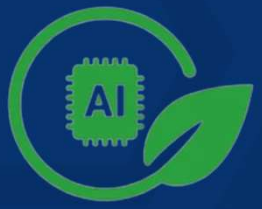
1 Introduction



Background

01

AI has become an unique field of research on environmental difficulties



02

The 17 SDGs can be organized into 3 main pillars: economic, social, & environmental.

03

Discuss sustainability in the context of how AI technology might contribute environment.

What is current issues, challenges, & prospects associated with the use of AI in the context of sustainable development ?

2 Environmental Pillar in SDGs

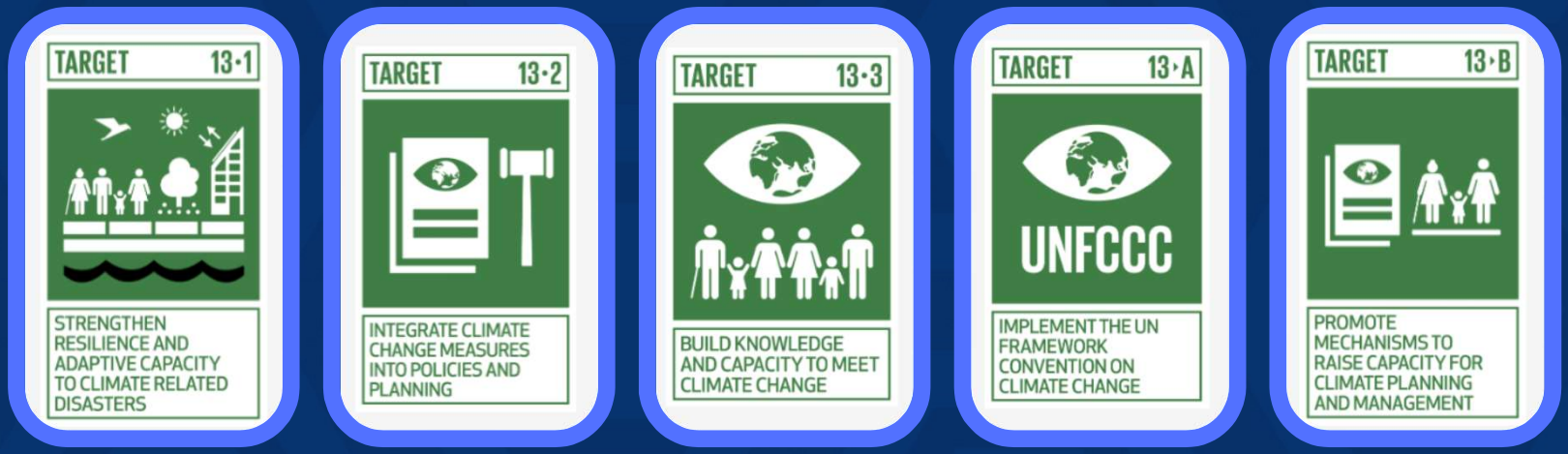
Society

Economy

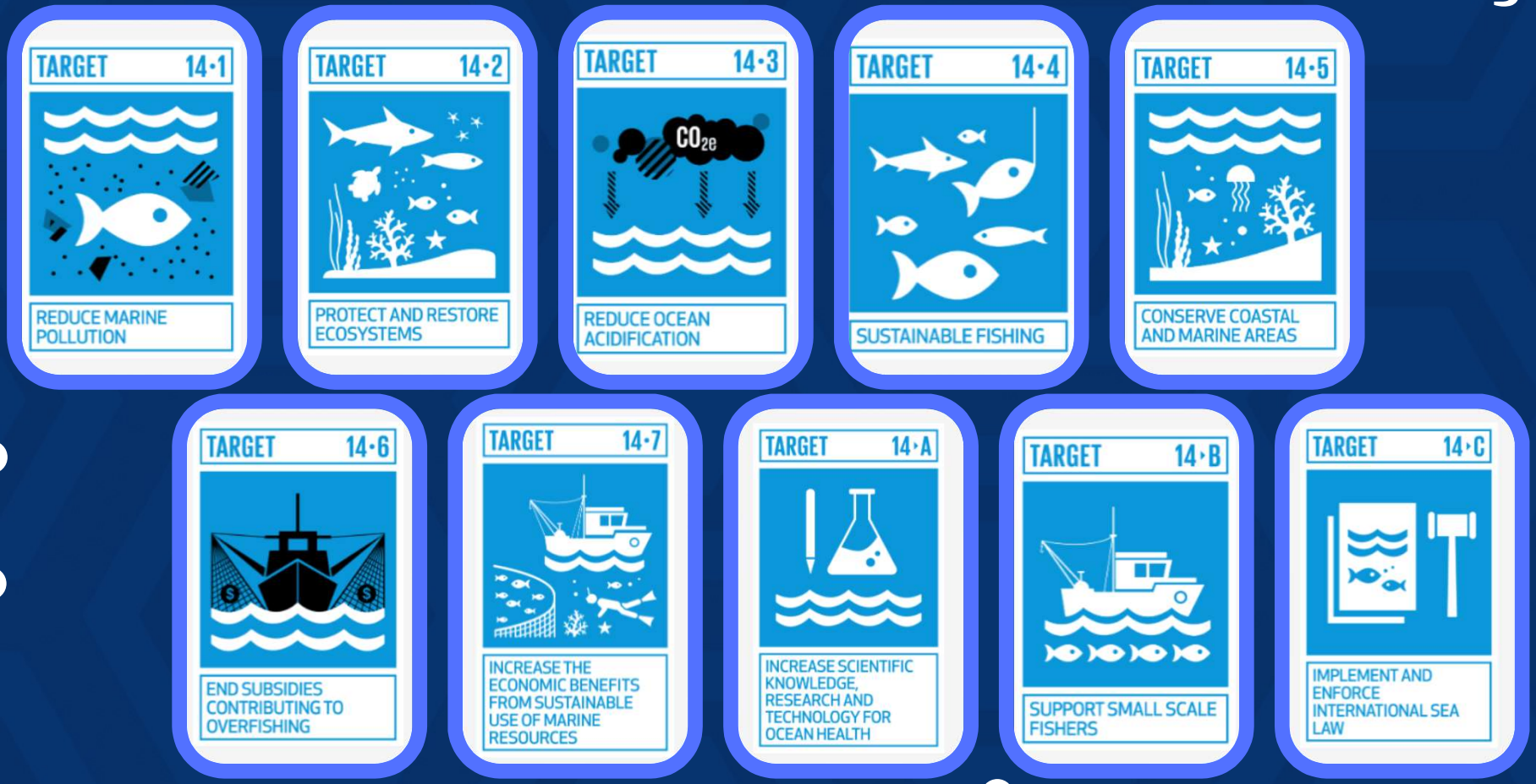
Environmental

www.globalgoals.org

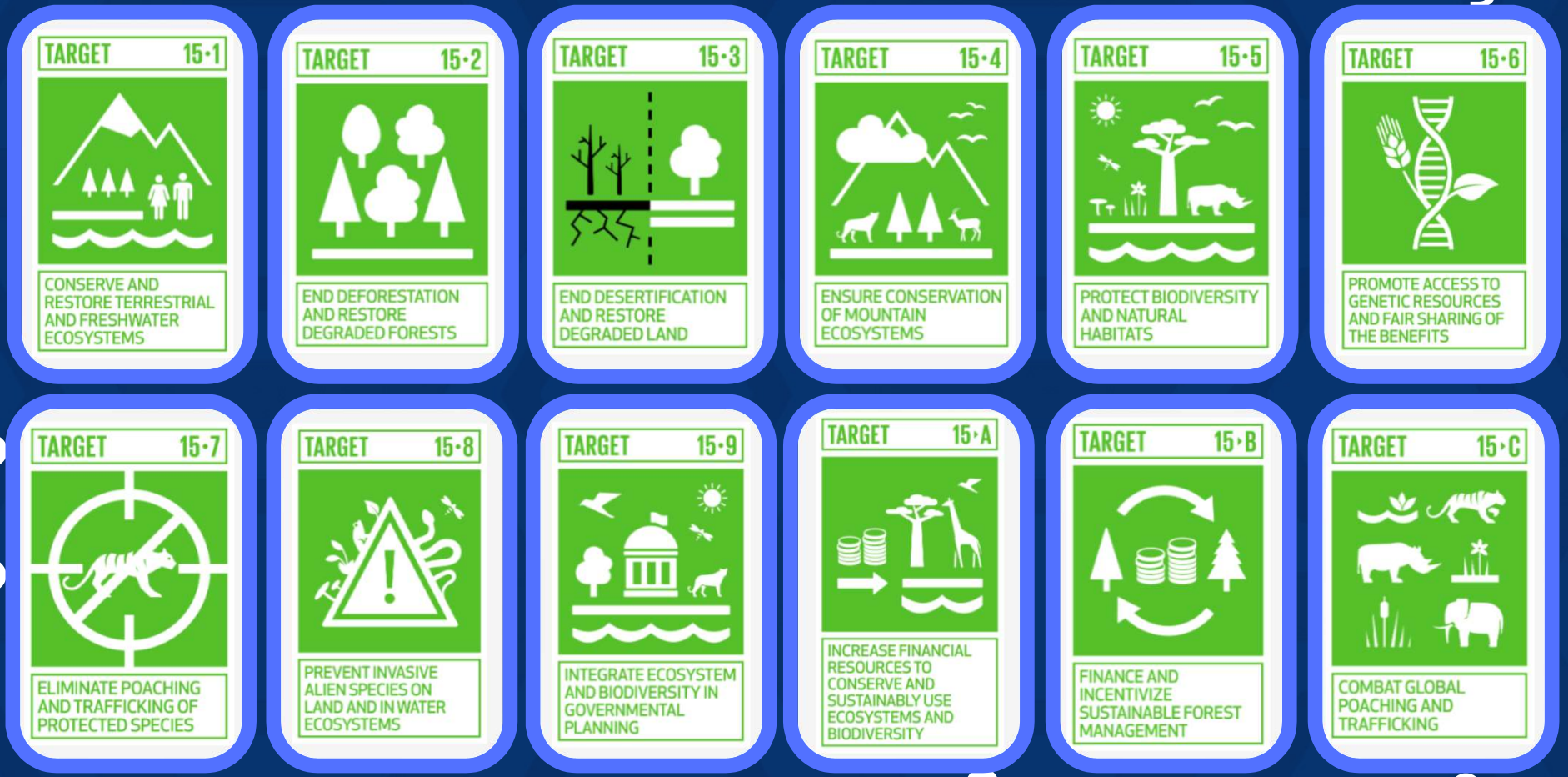
SDG 13 Targets



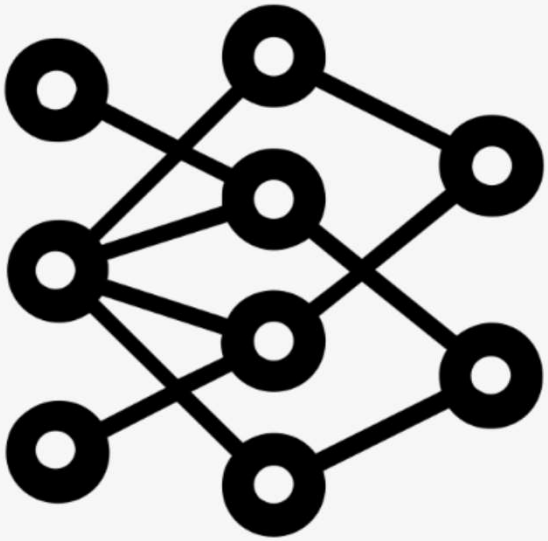
SDG 14 Targets



SDG 15 Targets



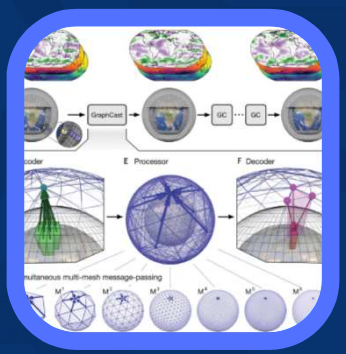
3 Current, Challenges, & Limitations of AI



Recent AI Application in SDG 13

IBM Watson

Design of Urban Heat Island Mitigation



GraphCast

Recent AI Application in SDG 14

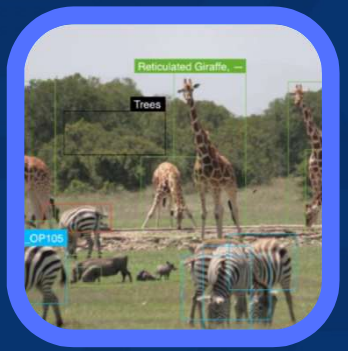
Ocean Cleanup

CoralNet

Ocean Surface Cleaning Autonomous Robot (OSCAR)

Recent AI Application in SDG 15

ForestNet



WildBook

Archangel Imaging

Challenges

1. Needs a lot of high-quality & large volumes data to train its algorithms.	2. Must filterred and denoise the data to ensure a good model fit.	3. Need a lot of processing power especially in robotics applications.
4. Requires a great dealof electricity, thus resulting carbon dioxide emissions.	5. AI technology produced e-waste that poses a environmental harm.	6. Can unintentionally perpetuate biases present in training data or reinforce discriminatory practices.

Limitations

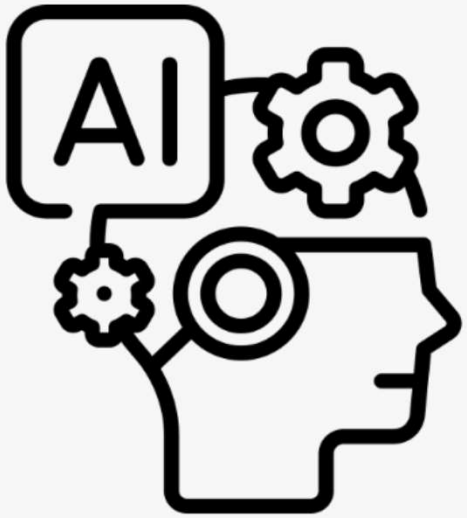
1. AI techniques mainly rely on human knowledge.

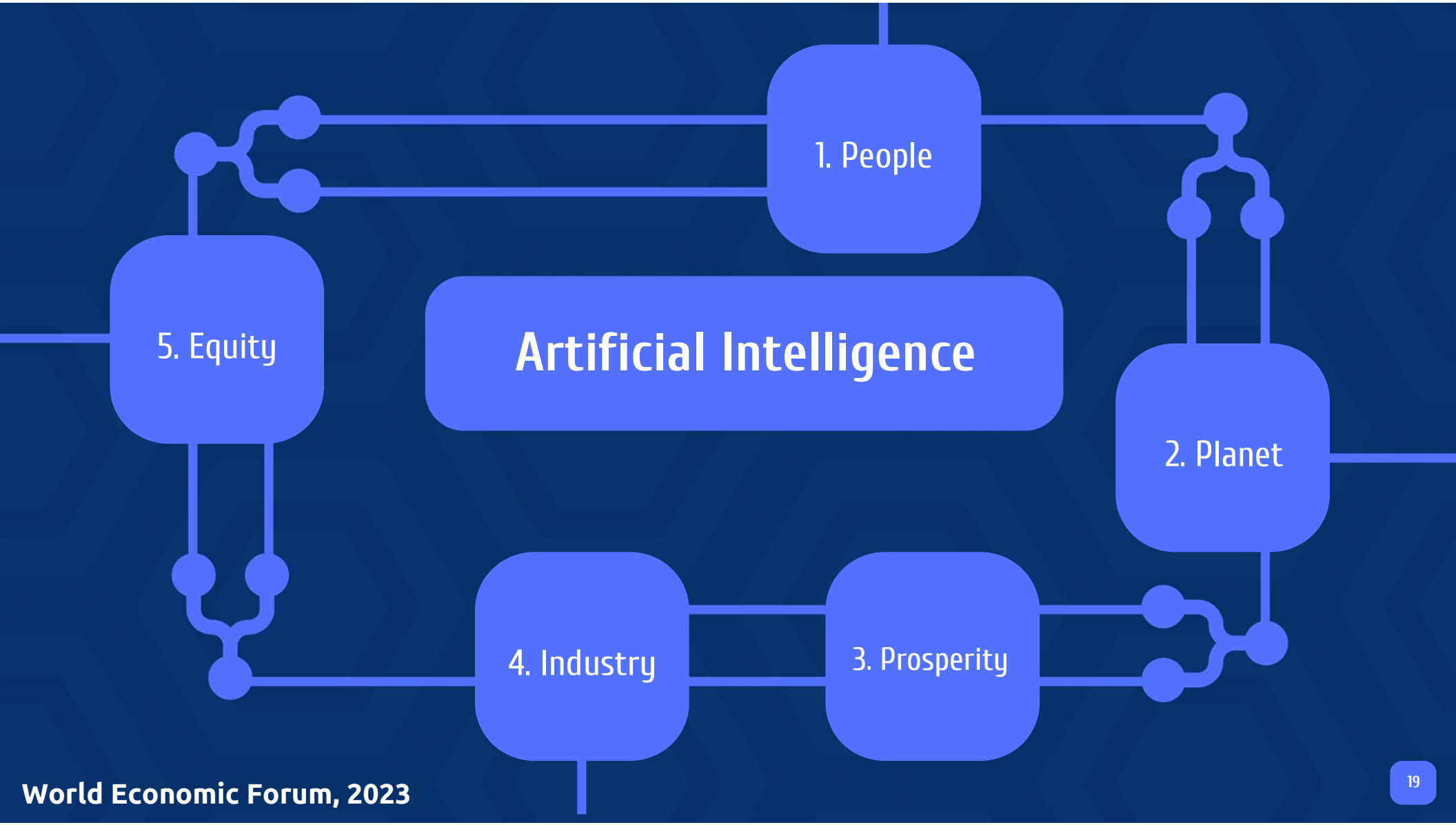
2. AI systems lack of emotional and social understanding

3. AI had hidden costs : Impending energy & resource strain

4. Problem on ethical & privacy concern

4 Future Impact Perspective





World Economic Forum, 2023

5 Study Case Using Taguchi & Artificial Neural Network

“An integrated model using Taguchi method & **artificial neural network** to improve artificial kidney solidification parameters"

Hemodialysis mainly relies on the “artificial kidney,” which plays a very important role in temporarily or permanently substituting for the kidney to carry out the exchange of waste and discharge of water.

Nevertheless, a previous study on the artificial kidney has paid little attention to the optimization of factors and levels for reducing the solidification of the artificial kidney during the hemodialysis procedure.

This study proposes an integrated model that uses the Taguchi method, omega formula, and back-propagation network to determine the optimal factors and levels for addressing this issue.

The Proposed Integrated Model

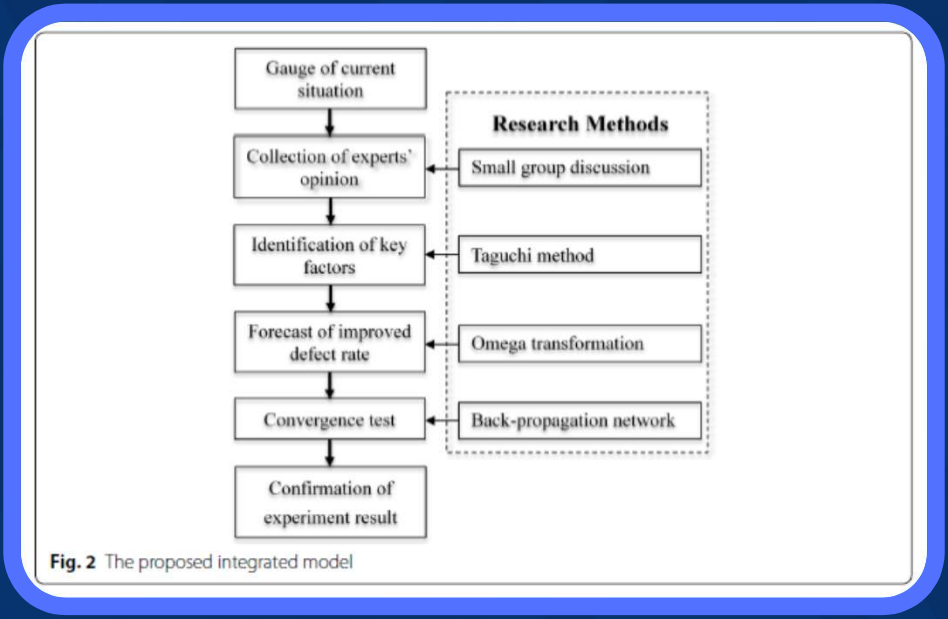


Fig. 2 The proposed integrated model

1. **Small group discussion:** extract important key factors and levels of artificial kidney solidification
2. **Taguchi method:** analyze factor & level effects to obtain optimal combination of factors & levels
3. **Omega transformation:** transform the binary data to estimate the defect rate.
4. **Artificial neural network:** utilize the back-propagation network to predict whether the proposed combination of optimal factors and levels is stable with low margins of error.

Good & Defective Artificial Kidneys

In this study with repeatedly used artificial kidneys as the research object, the proposed integrated model was used to improve the coagulation ratio of the artificial kidneys.

Conclusion

- The aims of this study were to reduce the solidification rate of artificial kidneys and conduct experiments on the cases.
- Before the improvement, the solidification rate of the artificial kidney was 32%; after the improvement, the solidification rate of the artificial kidney deceased to 12.9%.
- This matches the predicted defect rate of 13.17%, after omega conversion, and shows the correct rate of this study's results.
- Thus, integrating Taguchi method, omega transformation, & back-propagation network to determine the optimal factor parameters for the hemodialysis procedure, indeed makes a great contribution to the field of medical care.

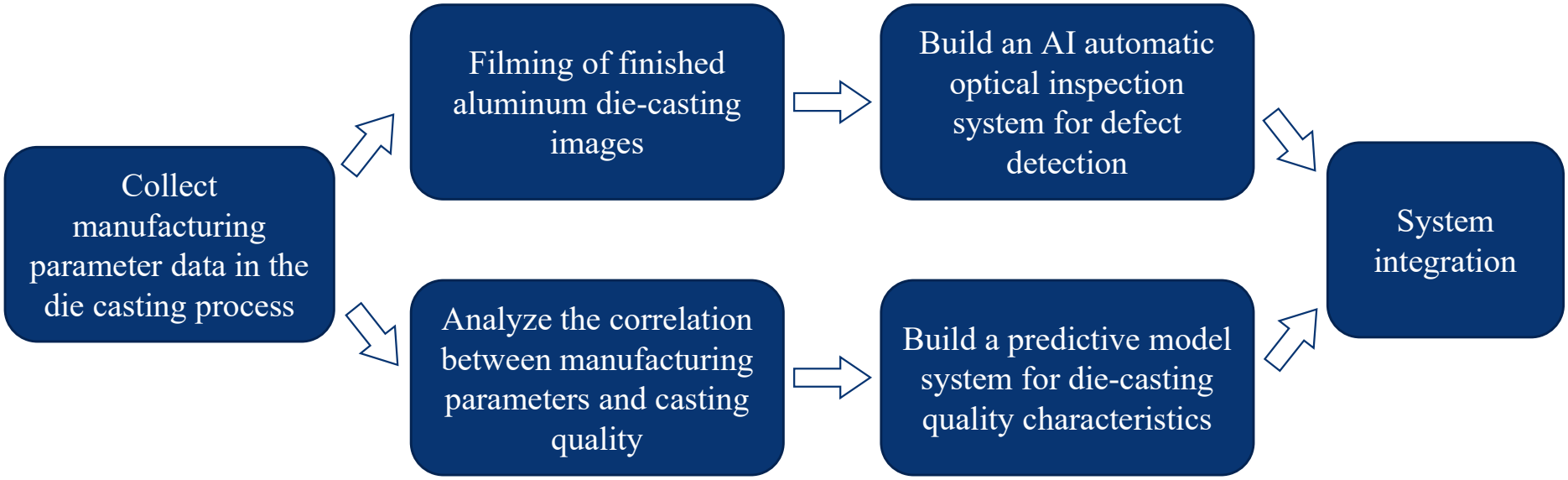
5

Study Case

Intelligent inspection of the appearance of aluminum die-casting

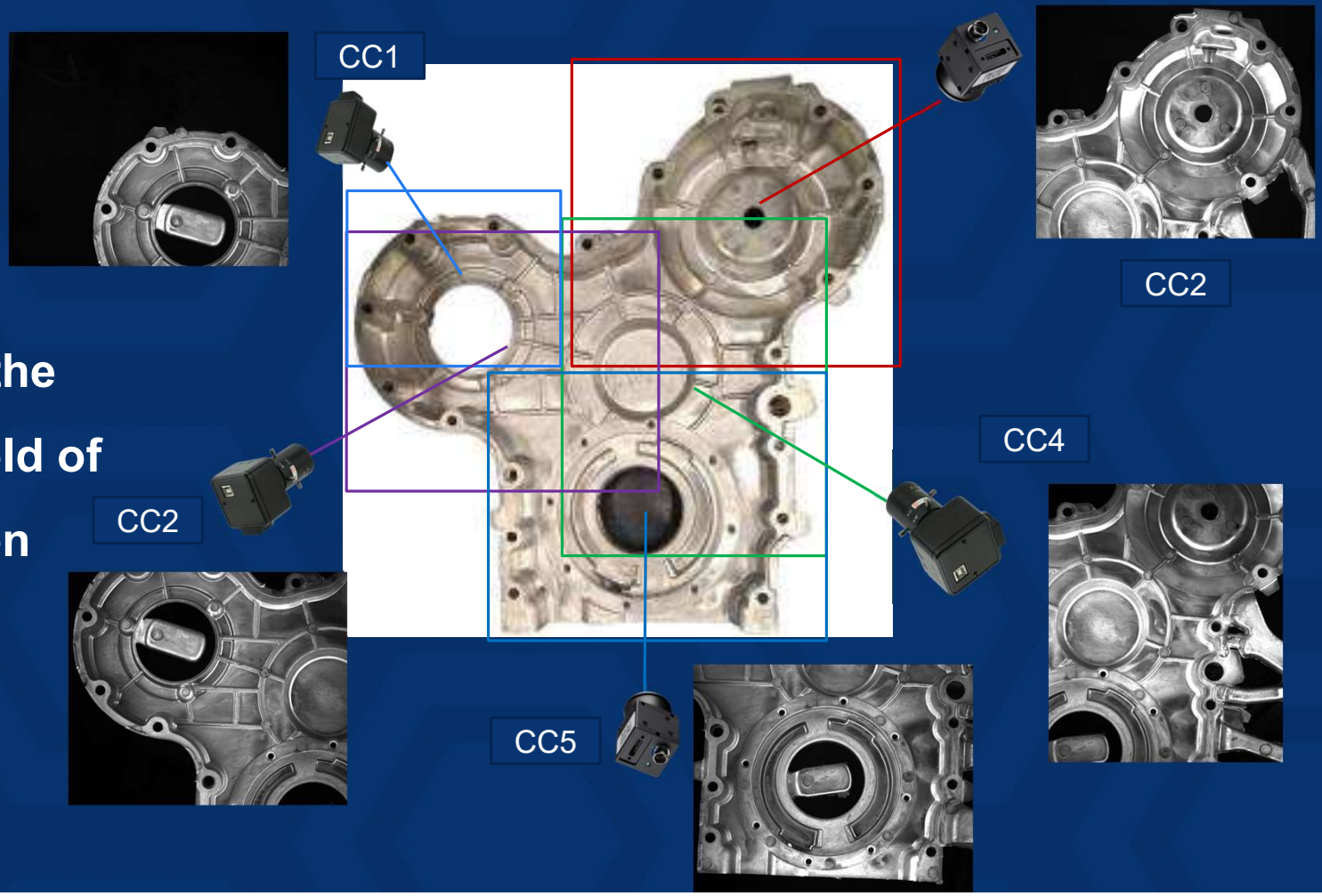
This project created two subsystems:

1. Automatic optical defect detection system-Use AI automatic image inspection technology to interpret defects in aluminum die casting images.
2. Casting quality prediction system-Collect manufacturing parameters and predict the quality of parts during die casting.



Data Collection

Schematic diagram of the camera's field of view position



Thank you!

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