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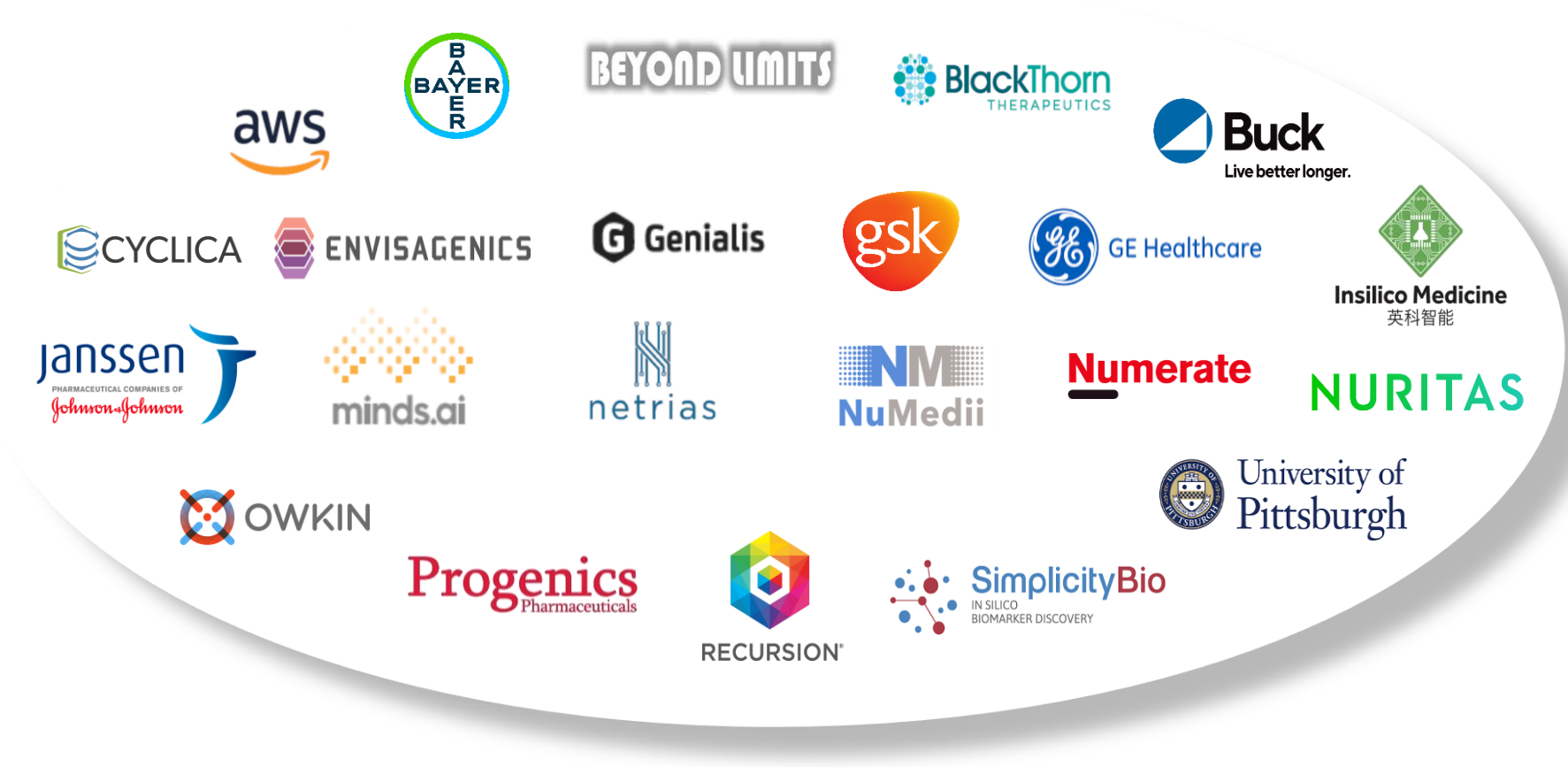
AAIH Founding Members: Unified Vision for Healthcare



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Quad-partite Mandate:
Facilitate Full Adoption and Integration of AI in Healthcare

AI in Healthcare Primer

Preview

AAIH TSDC @AI Gov

Oscar Rodriguez, Chief Architect at BlackThorn Therapeutics

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AI in Healthcare Primer

Purpose

- Introduce, define and clarify foundational topic and concepts
- Coalesce AAIH, the community it serves, & collaborators around a common language
- Provide a centering for follow-on activities in which AAIH & collaborators will engage
- Serve as a reference, lexicon, for our future discussions & publications

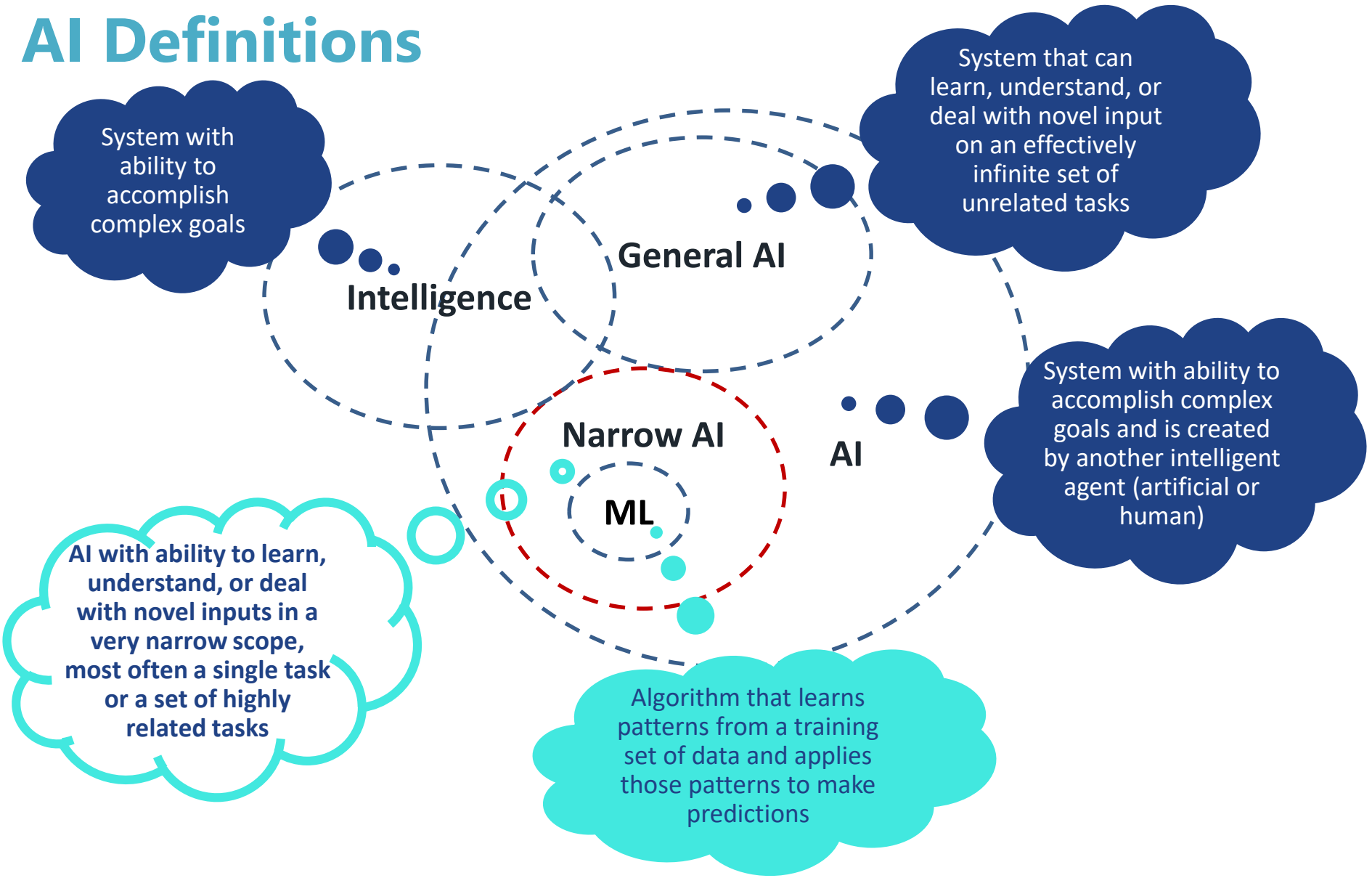
Audience

- Executives within healthcare organizations, NGO's & federal agencies (e.g., BioPharma)
- Healthcare Professionals & Administrative Personnel (e.g., doctors)
- Scientists (e.g., Lifescientists, Data Scientists)
- Investors (e.g., Technology & Lifesciences)

White Paper Topics

I. Abstract
II. Audience and Problem Statement
III. Executive Summary
IV. AI definitions and classification
V. Strengths of AI
VI. ML Techniques
VII. AI in Healthcare today and future
VIII. Related Topics that will influence AI in Healthcare
IX. Conclusions

AI Definitions



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Value of AI

- Ingests all Available Data and is Able to Build More Complex Models
- Models Can Be Deployed At Scale To Evaluate Orders Of Magnitude More Options
- Models Can Respond In Real-time (Micro-seconds)
- AI Systems Don’t Sleep
- AI Is Domain agnostic (e.g., Chemistry, Biology, Physics, Psychology, etc.)

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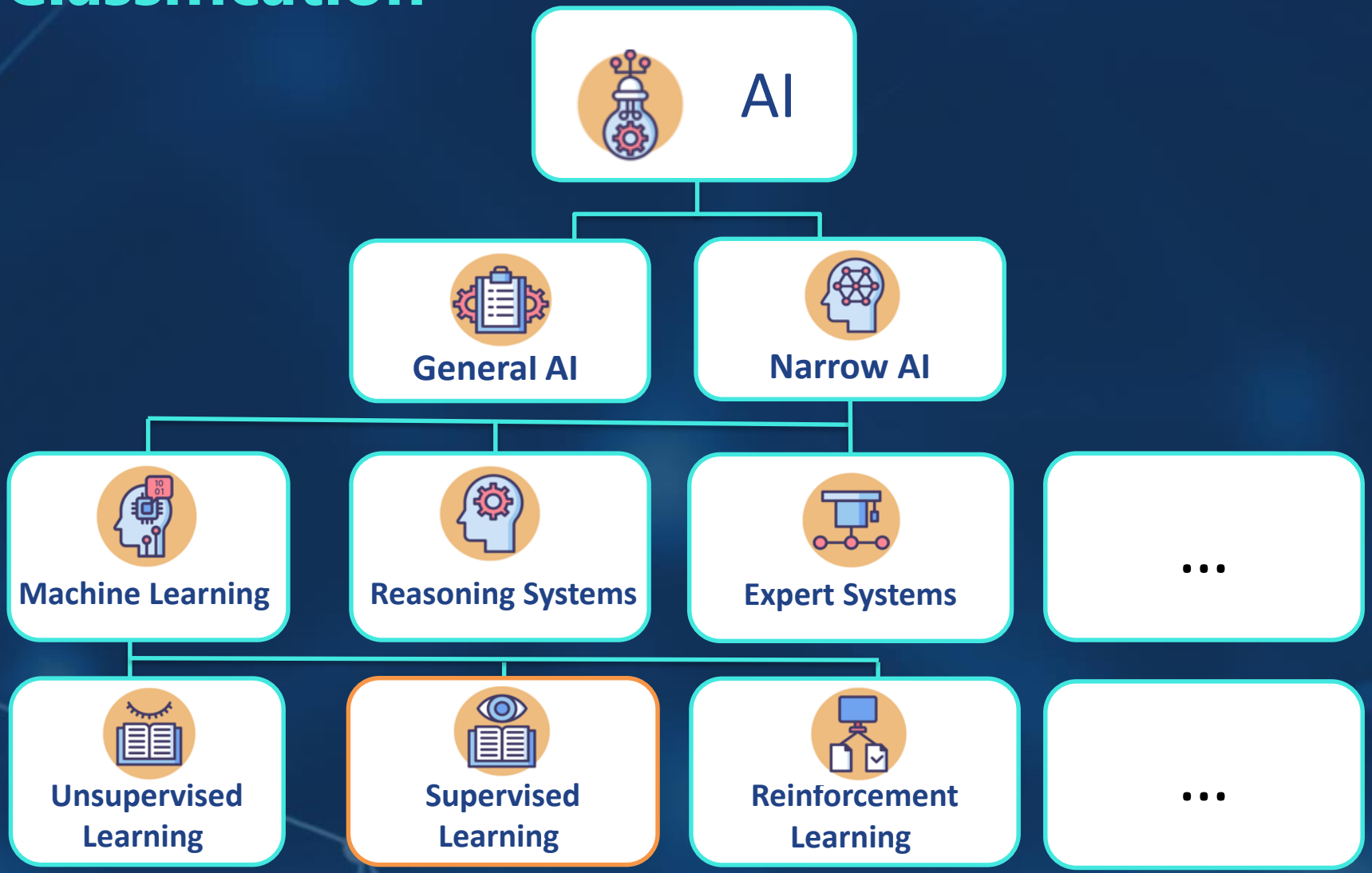
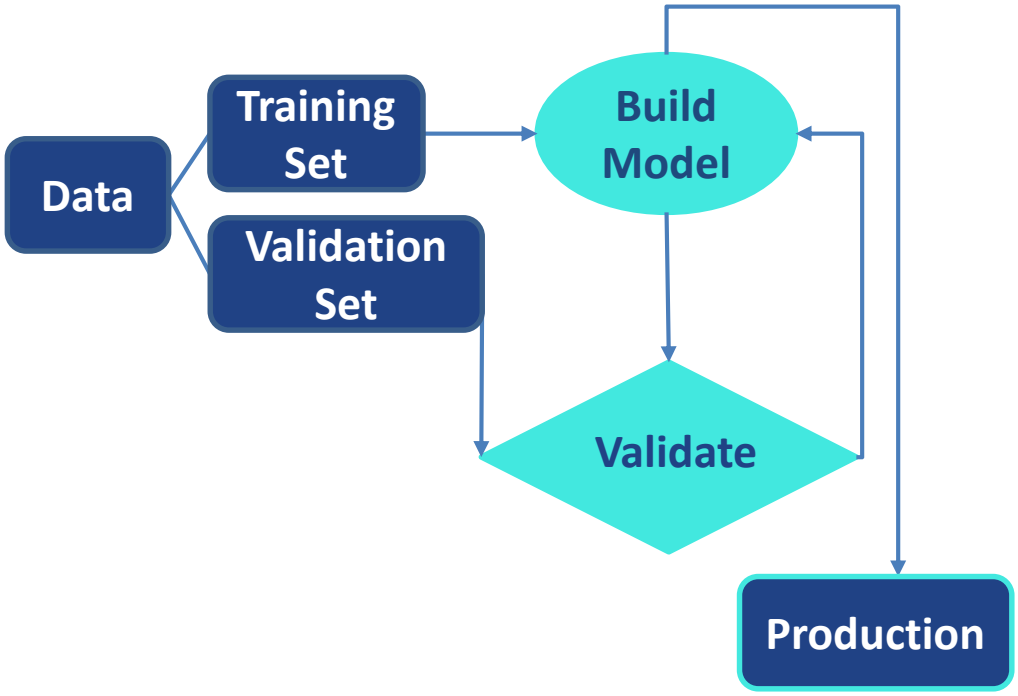
AI Classification



Narrow AI | ML Classification: Supervised Learning

Framework

- ML model trained on labeled data
- Model can be used to evaluate validation set to predict labels



Example: "Artificial Neural Networks for Estimation of Dementia Types"

- *Training Set:* 50 cases
- *Validation Set:* 40 cases
- *Features:* 30 Diagnostic parameters e.g., memory impairment, normal overall cognition, normal daily life etc
- *Labels:* Depending on values of *Features*, dementia types may be one of the following:
  - Mild cognitive disorder
  - Alzheimer's disease
  - Frontotemporal dementia
  - Other

Exemplar ML Techniques

Increasing Complexity

- Linear Regression
- Logistic Regression
- Decision Trees
- Clustering
- Evolutionary Algorithms
- Random Forest (RF)
- Support Vector Machines (SVM)
- Artificial Neural Networks (ANN)

Deep Neural Networks (DNN)

Techniques	*Sample Use Case*
Convolutional Neural Networks (CNN)	Skin Cancer Screening
Graph Convolutional Neural Networks (GCNN)	Small Molecule Toxicity Prediction
Autoencoders	Drug Target Interactions
General Adversarial Networks (GANs)	Small Molecule Design

Classification: Supervised Unsupervised Either

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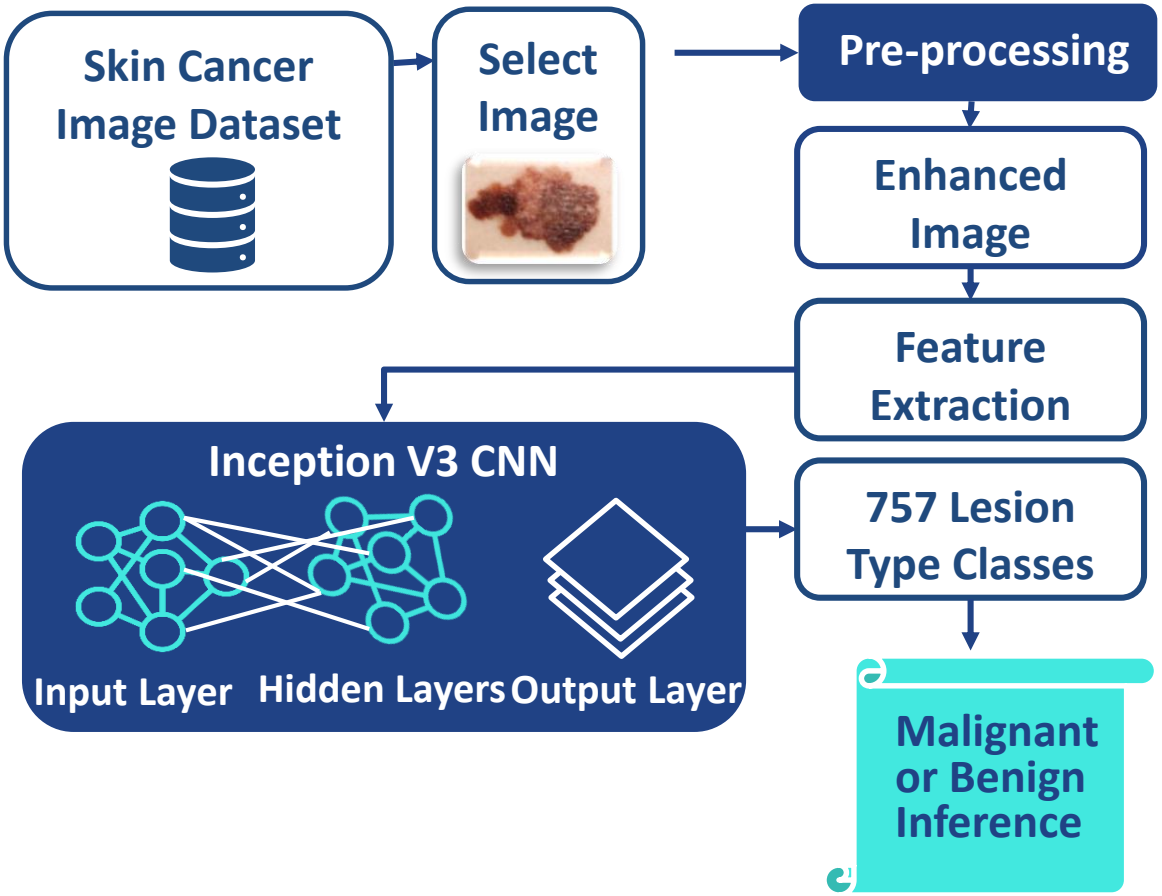
Why Is Usage Of Narrow AI The Obvious Future For Healthcare?

Example: Skin Cancer Classification Using CNN



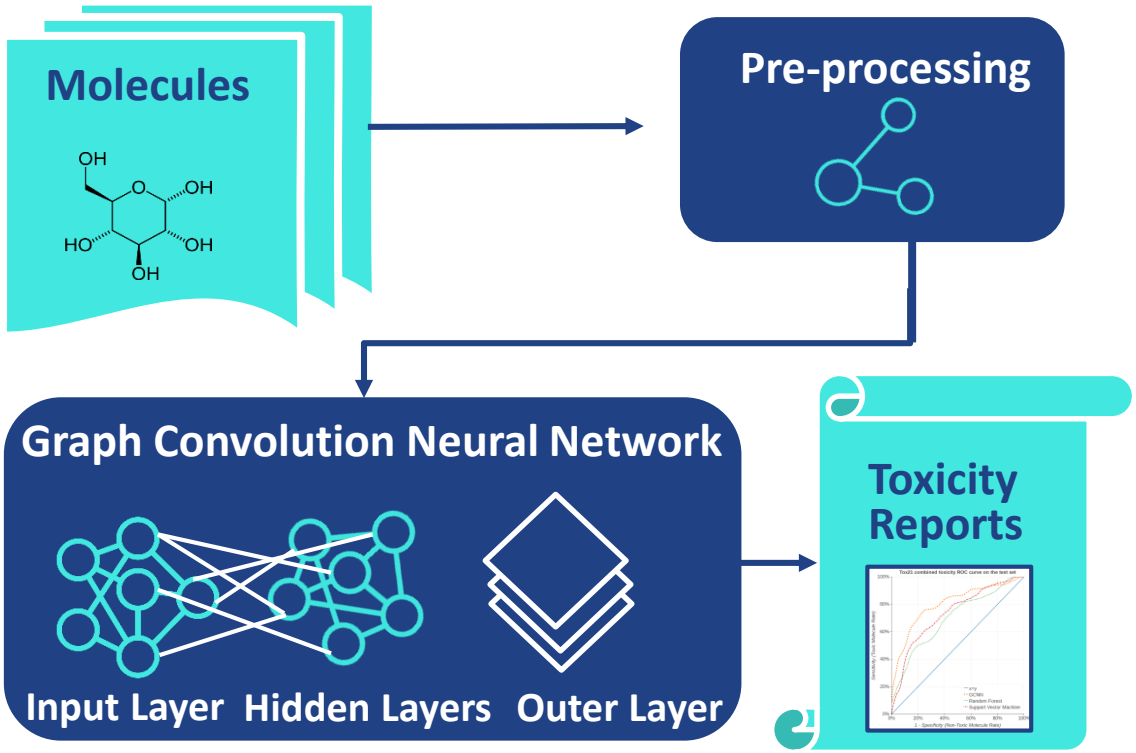
Esteva, A. et al., 2017. Dermatologist-level classification of skin cancer with deep neural networks. Nature, 542(7639), pp.115–118. Available at: http://dx.doi.org/10.1038/nature21056

Approach

- CNN (Convolutional Neural Network) to classify photos in order to detect skin cancer.
- *Inputs:* 129K clinical images labelled with 2K different diseases
- *Training:* Train CNN using this data; 757 skin lesion type training classes; malignant/benign inference classes
- *Validation:* Compare results with previously unseen images with the opinion of 21 trained dermatologists.

Why Is Usage Of Narrow AI The Obvious Future For Healthcare?

Example: Small Molecule Toxicity Prediction Using GCNN



Approach

- GCNN (Graph Convolutional Neural Network) to predict toxic reactions
- *Inputs:* molecules, encoded as SMILES strings during *Pre-processing* with accompanying list of known molecule properties
- *Training:* The deep neural network was trained using the public Tox21 dataset (contains 8015 training examples and labels for 12 toxicity targets)
- *Validation:* Process molecule from validation set

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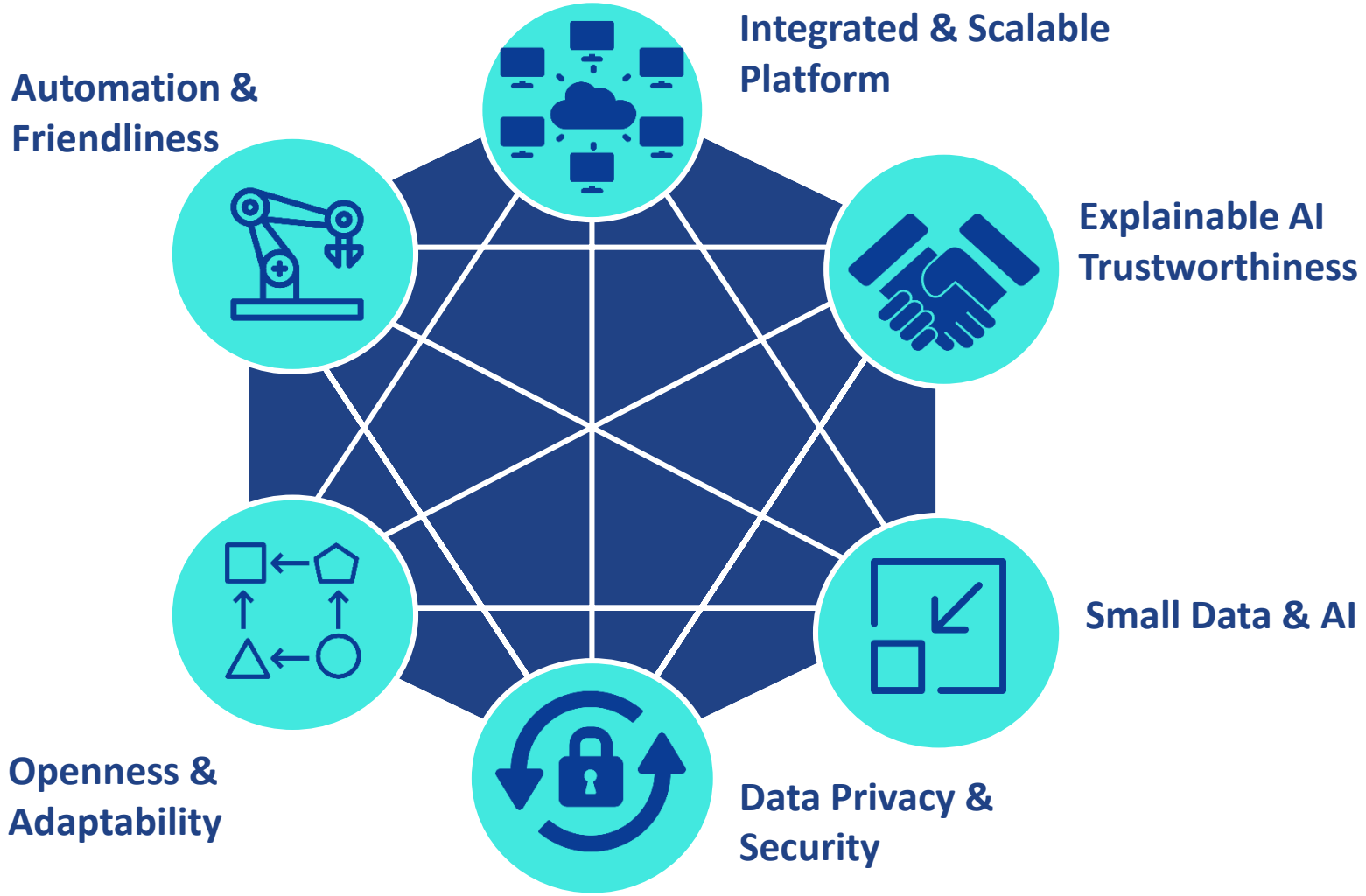
Best Practices For AI In Healthcare



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- Aaron Chang – Strategy and Technical Advisor at AAIH
- Annastasiah Mhaka – Co-founder and Convenor at AAIH

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Next Steps

- Complete V1 Of Definitions Paper - Target Date: July 10
- Solicit External Feedback – Target Date: July 24
- Publish V1 Of Definitions Paper – Target Date: August 1
- Continue Working On Additional AAIH TSDC Papers:

  Standards Landscaping

  Best Practices for AI in Healthcare

  Data Challenges

  Others TBD

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Fireside Chat:
AI and Healthcare, Perspectives from the U.S. Department of Energy

Fred Streitz, Ph.D.

Incoming Chief Scientist, DOE Office of Artificial Intelligence and Technology

Penelope Jones, M.S., M.Eng.

Senior Advisor, Office of the Secretary
Department of Energy

Moderator: Annastasiah Mudiwa Mhaka, Ph.D.

Co-founder & Convenor, Alliance for AI in Healthcare

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Case Study:
How Industry is Using AI in Healthcare

Angeli Moeller, Ph.D.

Head of IT Business Partnering Research, Bayer Business Services, Co-Lead of AI Workstream

Executive Officer and BoD Member, AAIH

BAYER

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Panel: How Federal Agencies are Advancing Public Private Partnerships in Healthcare

Kate Cook, J.D.

Former Assoc. Chief Council FDA | Exec VP, Drug and Biological Products, Greenleaf Health

Susan Gregurick, Ph.D.

Director, NIH National Inst. Of General Medical Sciences, Division of Biophysics, Biomed Tech, and Computational Biosciences

Moderator: Jason Paragas, Ph.D.

Former DOE, DoD, NIH | VP Integral Therapeutics

June Lee, M.D. Ph.D.

Chair, NIH Artificial Intelligence Interest Group and AI Working Group for Autonomous Therapeutics

Ronald Poropatich, M.D., Colonel (Ret.)

Former Dep. Director U.S. Army Medical Research and Material Command | Prof. of Medicine, Exec Director Center for Military Med. Research, Univ. of Pittsburgh

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