



FROM INNOVATION TO IMPLEMENTATION: Digitalization and Artificial Intelligence

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How these terms are used?

INNOVATION

IMPLEMENTATION

DIGITALIZATION

ARTIFICIAL INTELLIGENCE



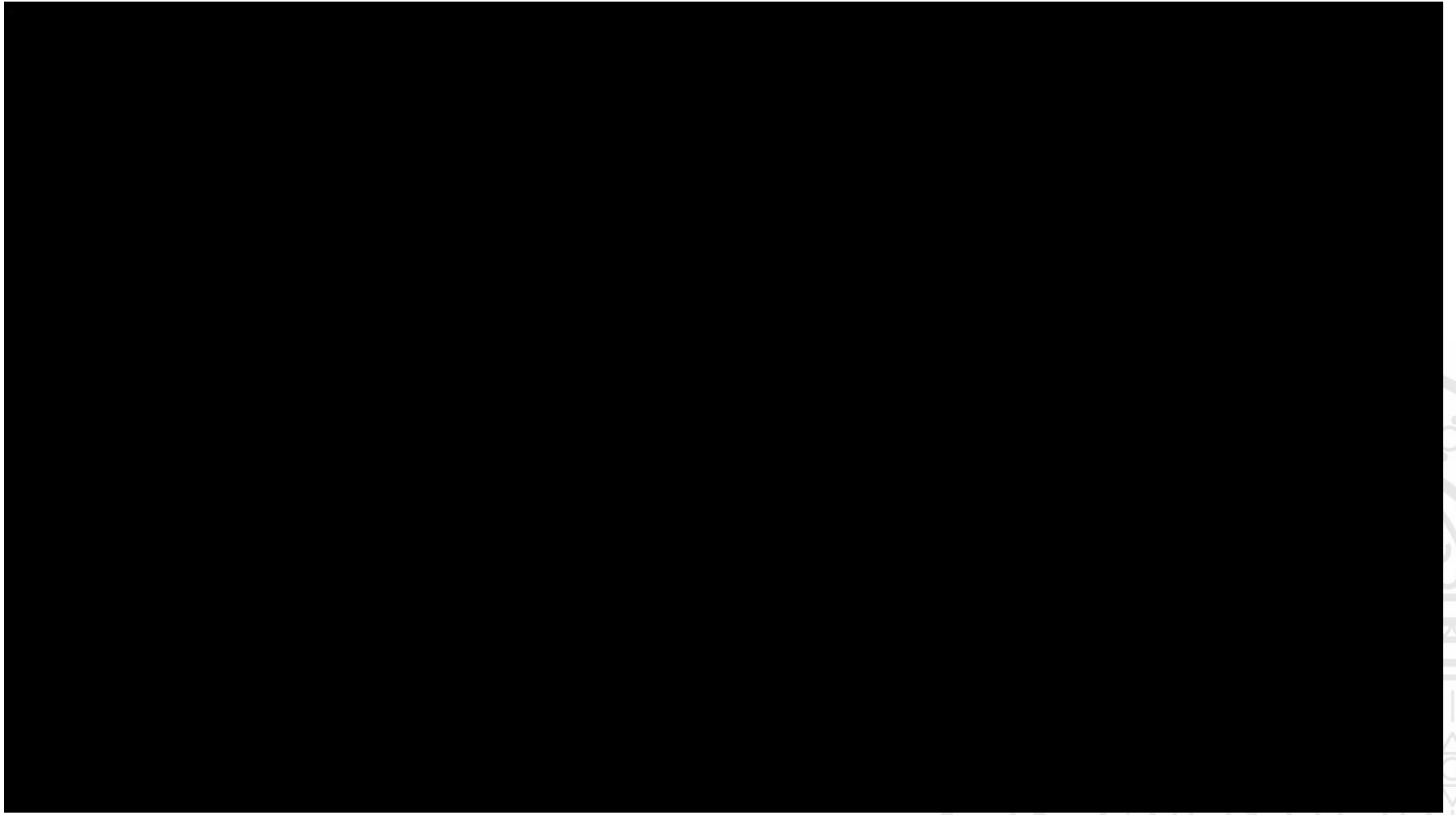
INNOVATION: DESIGN THINKING

Design Thinking is often defined as "an **analytic** and **creative** process that engages a person in opportunities to experiment, **create** and **prototype** models, gather **feedback**, and **redesign**". [1]

Methods

- Business Model Canvas
- Value Proposition Canvas
- Empathy Map Canvas
- Customer Journey Canvas
- Stakeholder Map
- Storyboards

WORKSHOP SETTING @ NEMO SUMMERSCHOOL

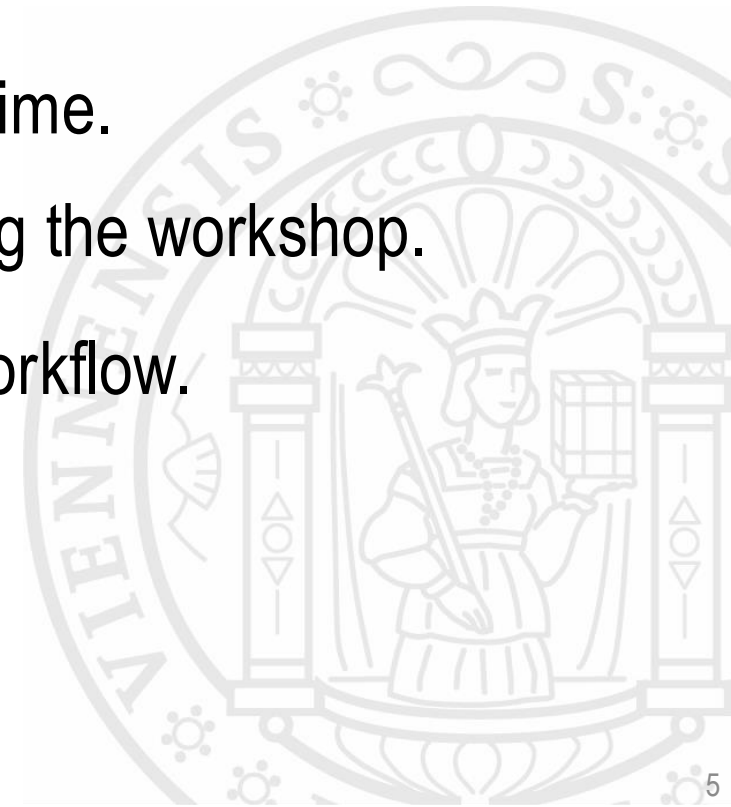


IMPLEMENTATION: REALIZING DIGITAL TWIN

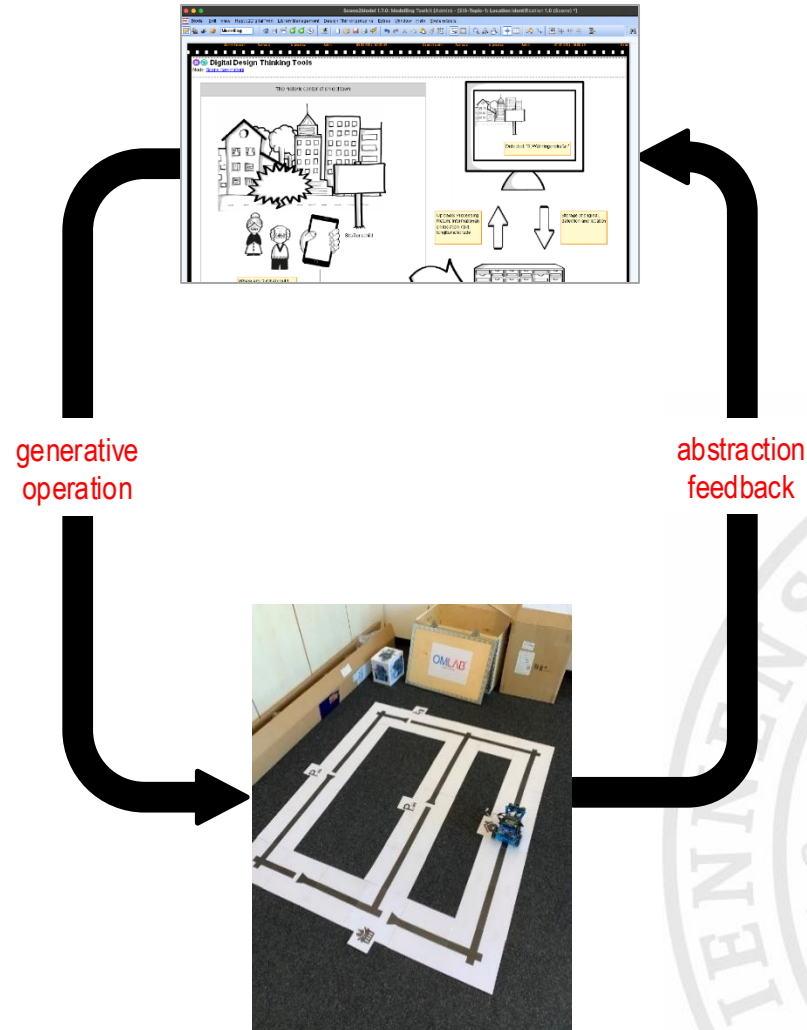
To realize design thinking results, we **need** a **digital representation** : a **Digital Twin**.

What realizing should support?

- **Interact** with the storyboard at any time.
- **Share** the knowledge created during the workshop.
- **Connect** the scenario to a digital workflow.

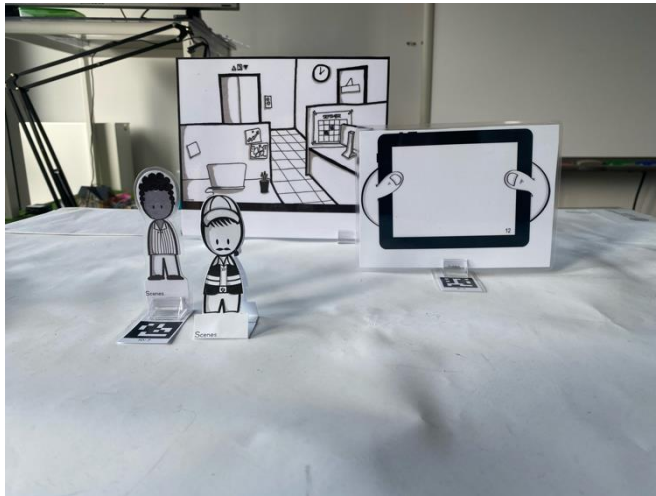


IMPLEMENTATION: REALIZING DIGITAL TWIN

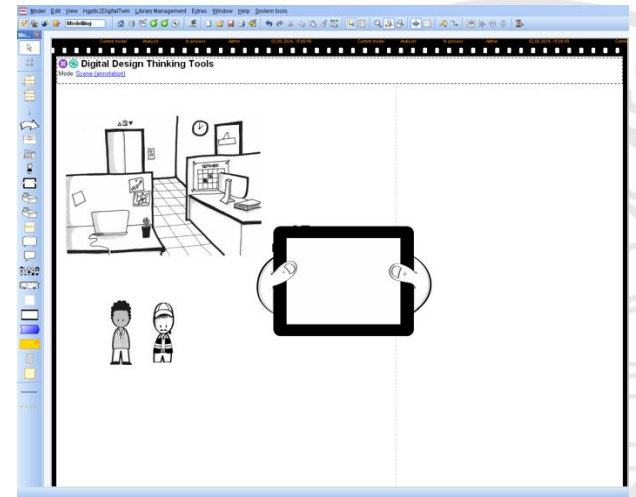


DIGITALIZATION

We consider a **Digital Twin** as a digital representation of a haptic element such that we can perform operations such as simulation.



Haptic scene



Digital Twin of the haptic scene

ARTIFICIAL INTELLIGENCE

What AI technology **enables**?

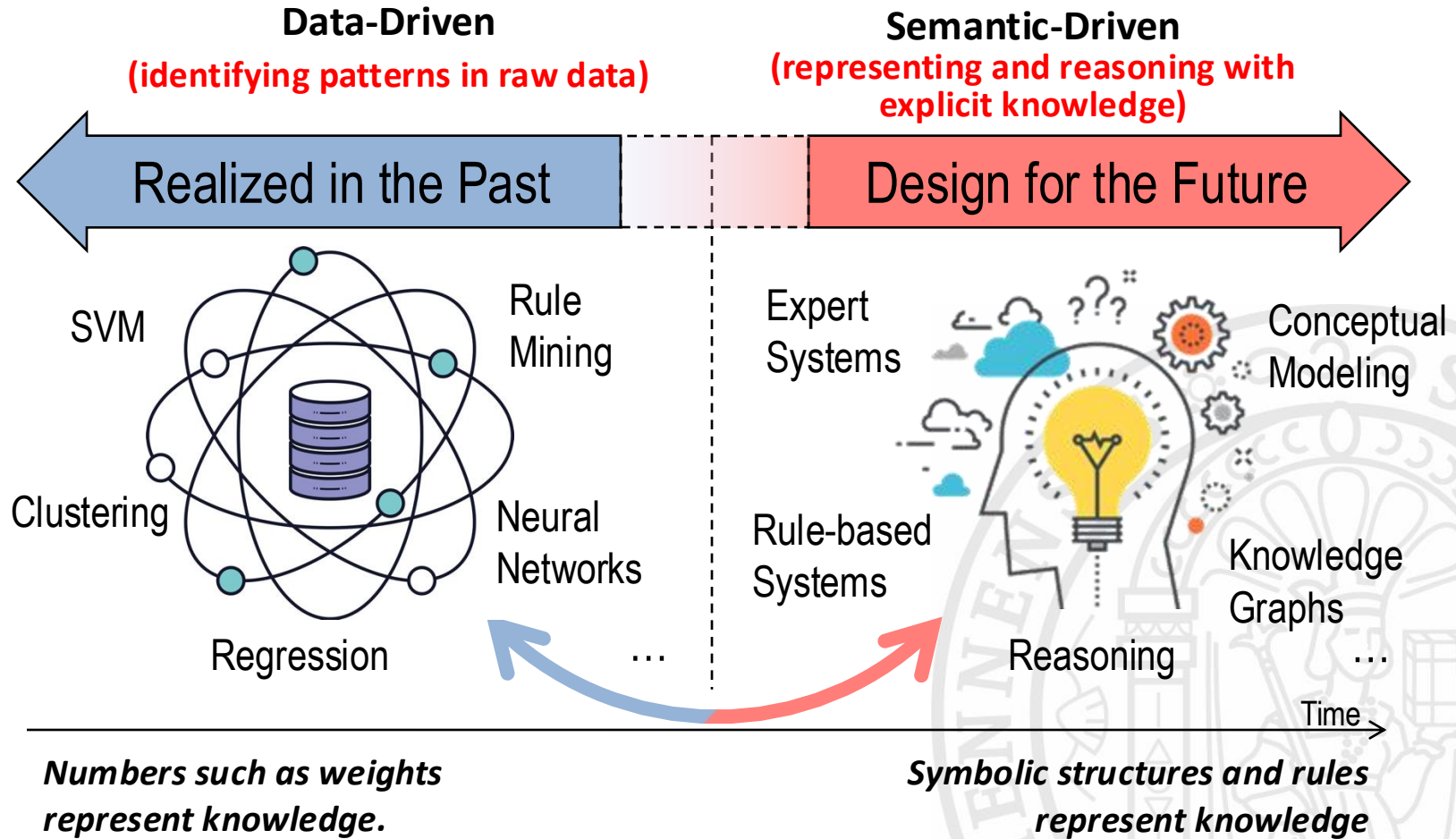
Enhance functionality of tools/techniques based on **data** and **algorithms**

What **enables** AI technology?

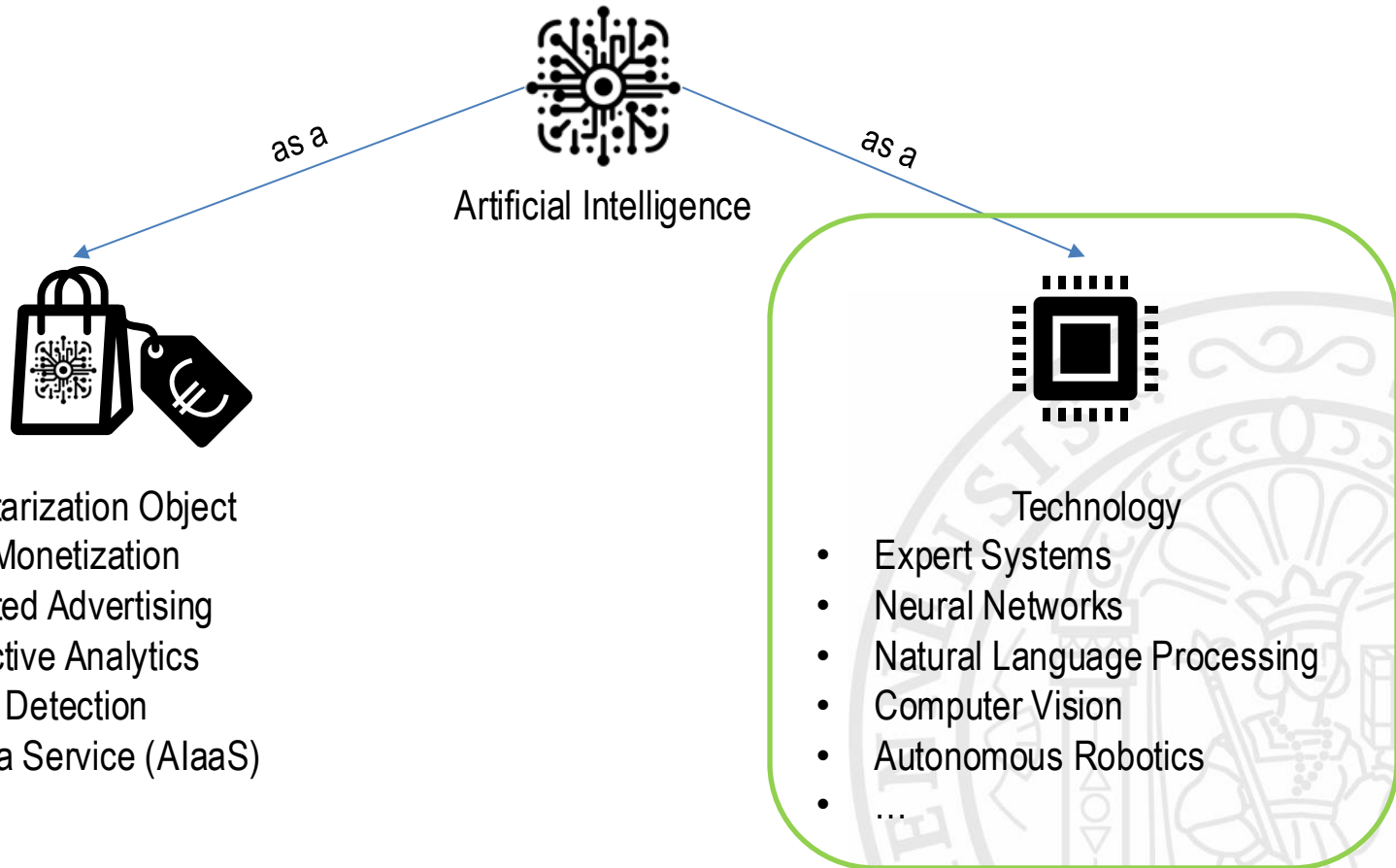
- Data,
- Networks/Communication,
- Computational power, and
- Easy access/Digital devices



SOURCE OF KNOWLEDGE WITHIN AI



ARTIFICIAL INTELLIGENCE: A TECHNOLOGY VIEW



AI MODELS: FUNCTIONS, FOUNDATIONS AND PLATFORMS

Functions

Classification



Prediction



Recognition



Generation



Some Applications



Darknet



Alpha Go



YOLO CNN



ChatGPT

Foundations

Classification:

SVM, Decision Tree, NN, ...

Prediction:

RNN, LSTM, GNN, ...

Recognition

CNN, Computer Vision, ...

Generation

GAN, VAE, Transformer Model, ...

SVM: Support Vector Machine

NN: Neural Network

RNN: Recurrent Neural Network

LSTM: Long Short-Term Memory Network

GNN: Graph Neural Network

CNN: Convolutional Neural Network

GAN: Generative Adversarial Network

VAE: Variational Autoencoder

AI MODELS: CONCEPTUAL AND MATHEMATICAL

Functions

Classification



Prediction



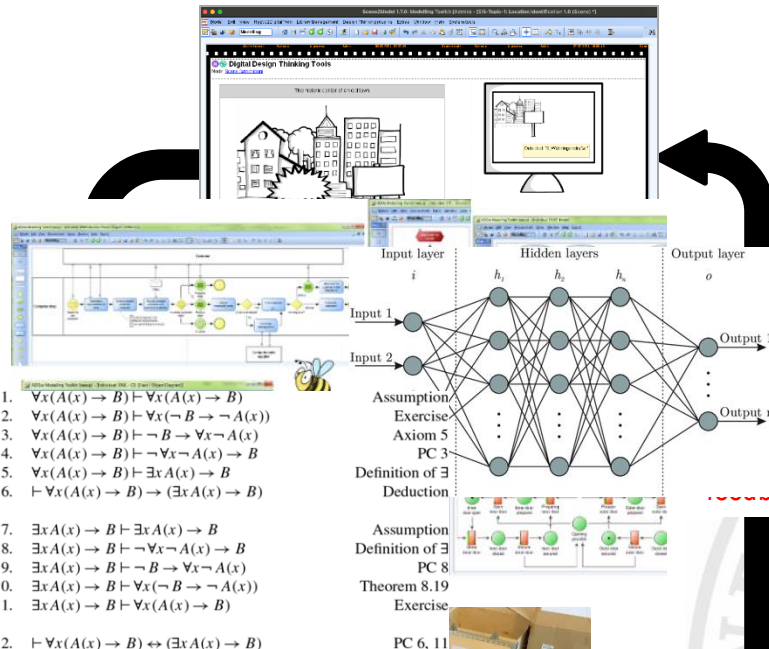
Recognition



Generation



An Application



Some Platforms

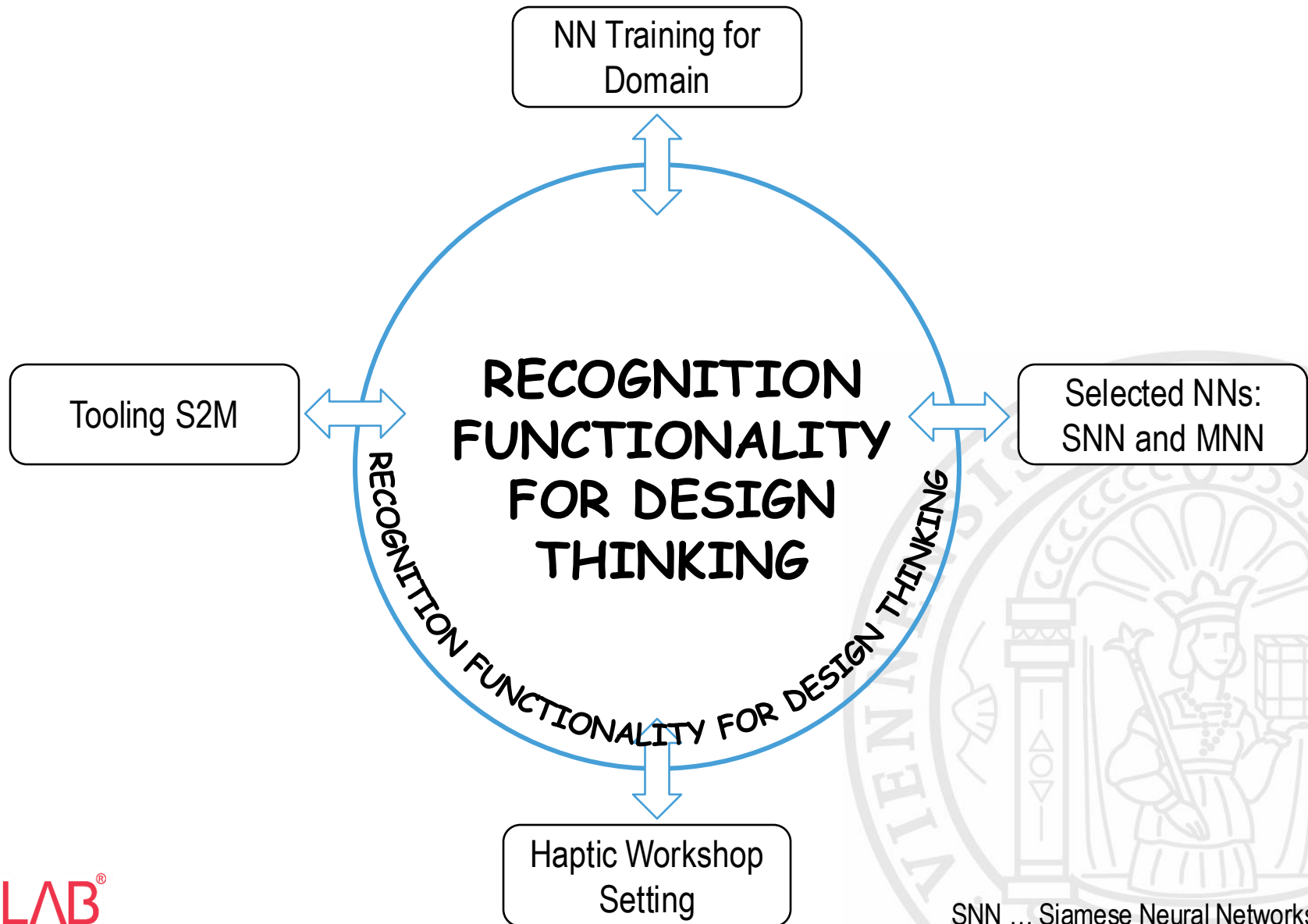


Source: [10.1016/j.enbuild.2017.11.045](https://doi.org/10.1016/j.enbuild.2017.11.045)
https://doi.org/10.1007/978-1-4471-4129-7_8

A NEURAL NETWORKS CASE



AN AI APPLICATION: NEURAL NETWORKS



SNN ... Siamese Neural Networks
MNN ... Matching Neural Networks

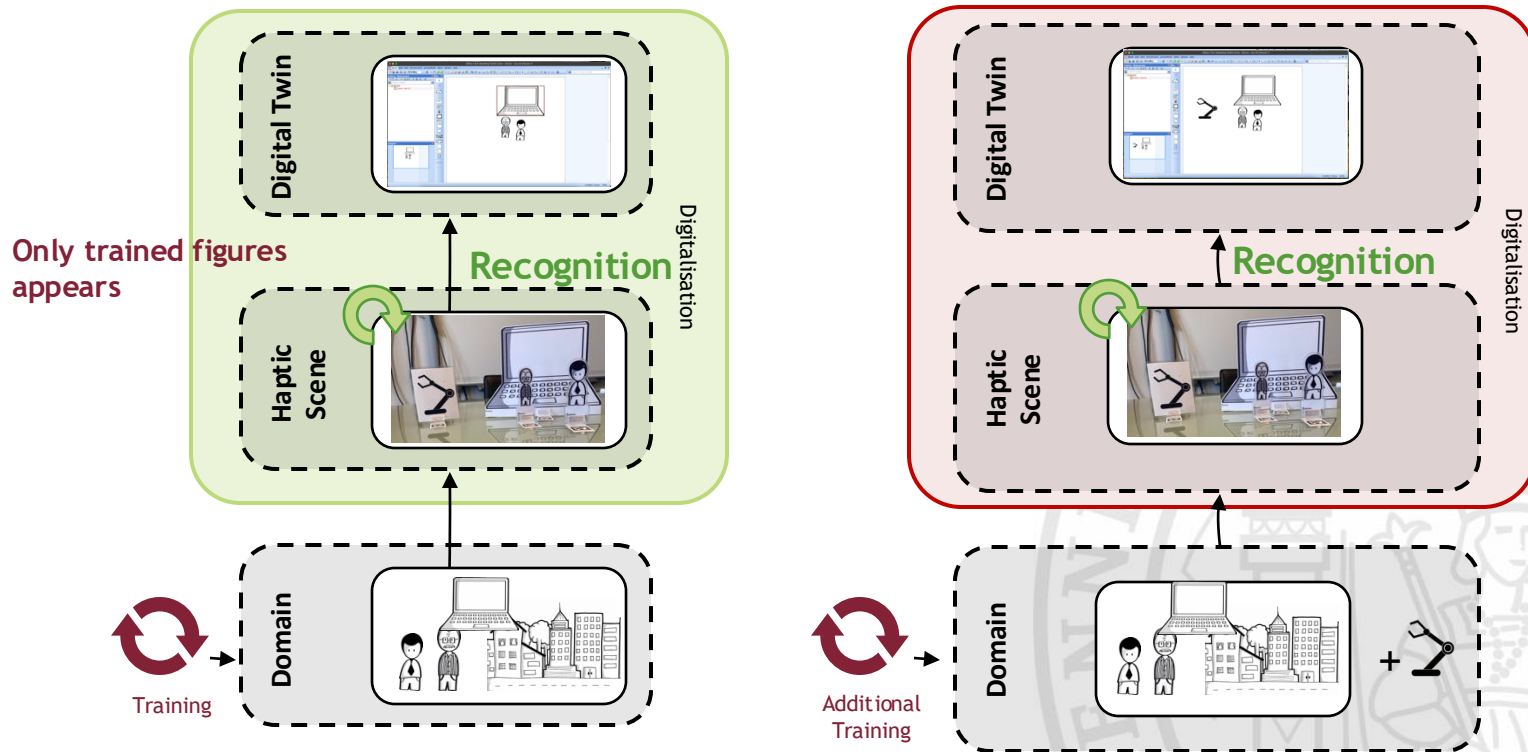
ANN TRAINING APPROACHES

ADDITIONAL TRAINING

Domain

Training for
Domain

What happens if a non-trained figure is needed?



TRAINING MODELS: <https://lifearchitect.ai/models-table/>

GPT-5	<i>Mar/2024</i>	H100	989	50,000	120 days	144,000,000	16,428 years	\$612M
Olympus	<i>Aug/2024</i>	H100	989					

Model	Training end	Chip type	TFLOP/s (max)	Chip count	Wall clock time (days)	Total time (hours)	Total time (years)	Retail cost (\$US)
GPT-3	<i>Apr/2020</i>	V100	130	10,000	15 days	3,552,000	405 years	\$9M
Llama 1	<i>Jan/2023</i>	A100	312	2,048	21 days	1,032,192	118 years	\$4M
Llama 2	<i>Jun/2023</i>	A100	312	2,048	35 days	1,720,320	196 years	\$7M
Titan	<i>Apr/2023</i>	A100	312	13,760	48 days	11,558,400	1,319 years	\$45M
GPT-4	<i>Aug/2022</i>	A100	312	25,000	95 days	57,000,000	6,503 years	\$224M
Gemini	<i>Nov/2023</i>	TPUv4	275	57,000	100 days	136,800,000	15,606 years	\$440M
Llama 3 70B	<i>Apr/2024</i>	H100	989	24,576	11 days	6,300,000	719 years	\$7M
Llama 3 405B	<i>Apr/2024</i>	H100	989	24,576	50 days	29,491,200	3,364 years	\$125M
GPT-5	<i>Mar/2024</i>	H100	989	50,000	120 days	144,000,000	16,428 years	\$612M
Olympus	<i>Aug/2024</i>	H100	989					
Grok 2	<i>Jun/2024</i>	H100	989	20,000	50 days	57,600,000	6,571 years	\$245M
Gemini 2	<i>Nov/2024</i>	TPUv6	1847					
Grok 3	<i>Dec/2024</i>	H100	989	100,000	50 days	288,000,000	32,855 years	\$1.2B

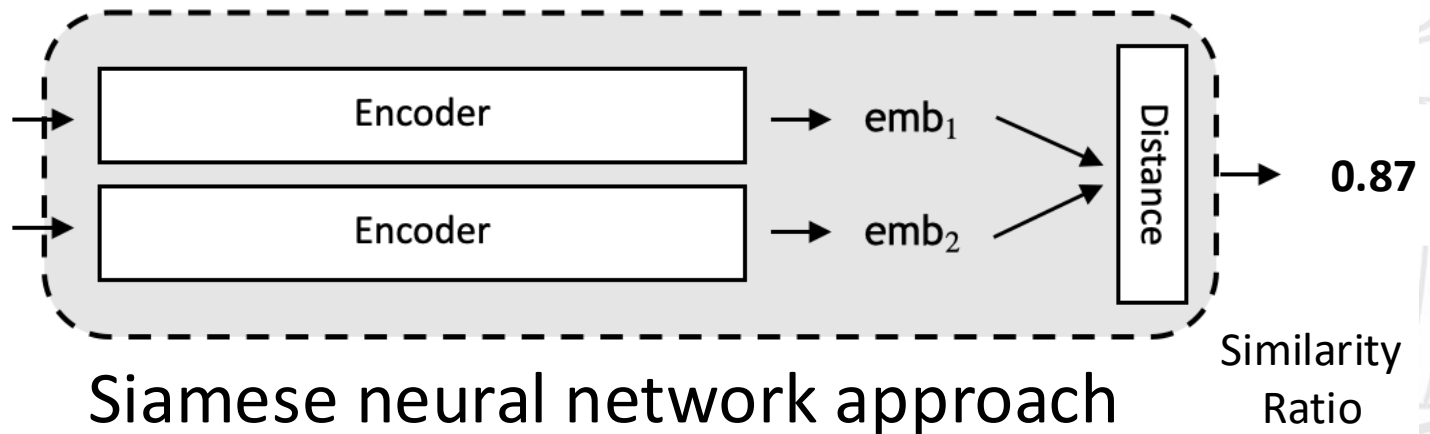
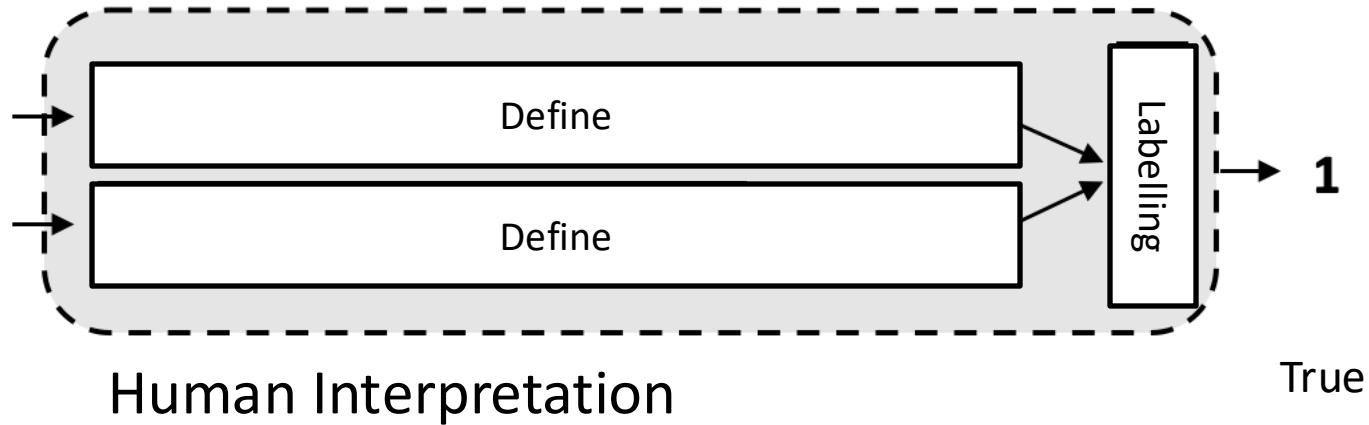


ANN TRAINING APPROACHES

CLASSIFICATION APPROACH

Domain

Training for
Domain

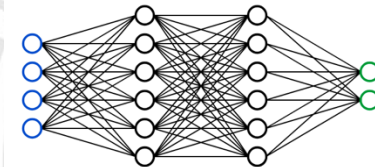
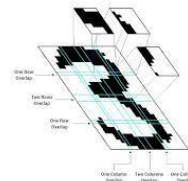


ARTIFICIAL NEURAL NETWORKS FOR RECOGNITION

We consider **recognition** as the task of locating and identifying objects in an image. It can be done either by a **machine** either by a **human**.

Methods

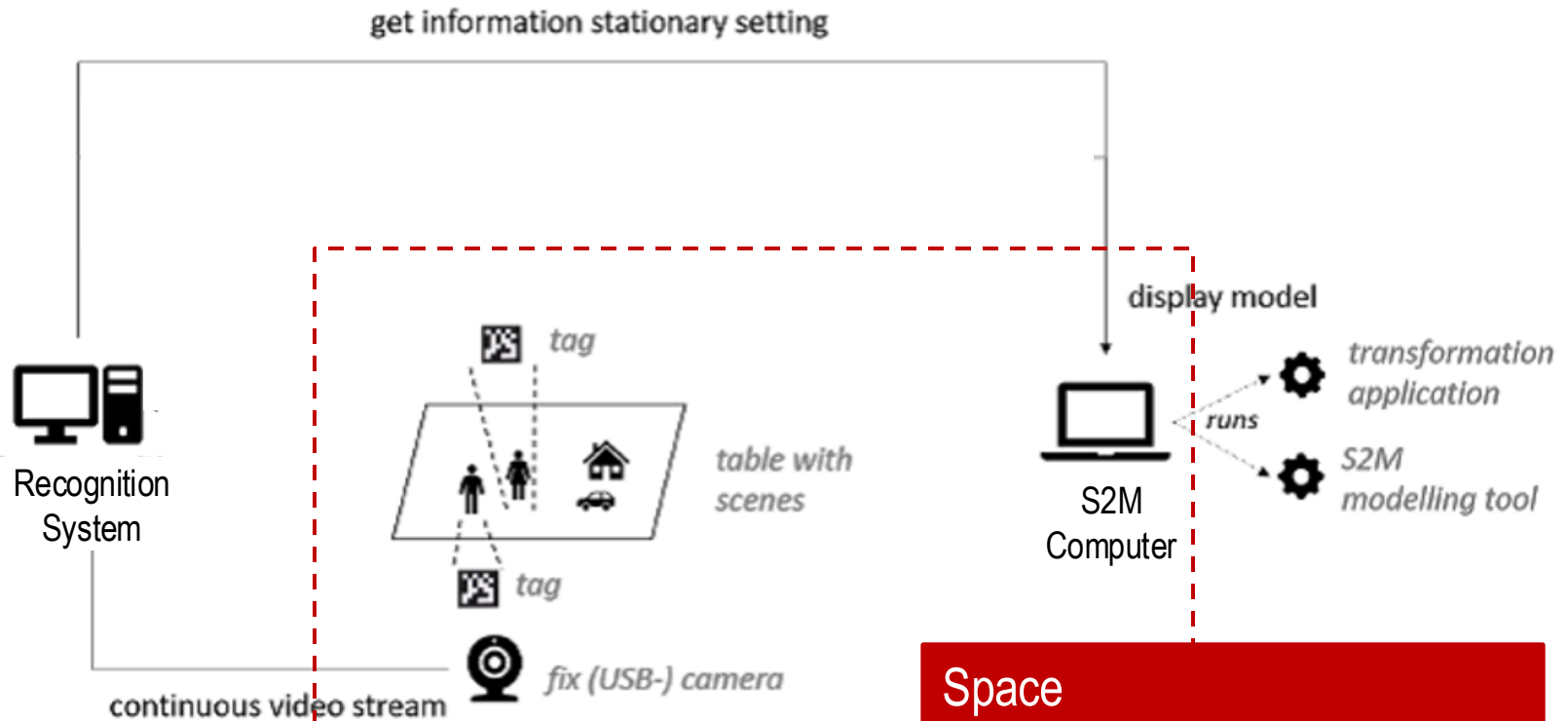
- Pattern recognition
- Artificial Neural Networks
- Hybrid Methods



WORKSHOP SETTING

Environment

Haptic Workshop
Setting



Space
Experts
Haptic Elements
Camera Setup
Workshop Infrastructure

enables the transformation of haptic Design Thinking scenes into digital models that can be further adapted, processed, shared, etc...



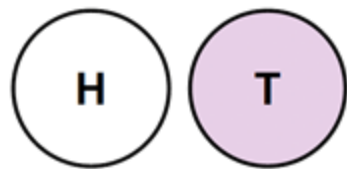
Further information at:
<https://scene2model.omilab.org>



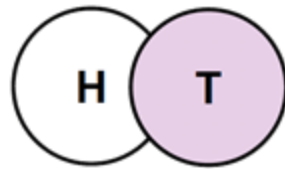
CONCLUSION & DISCUSSION



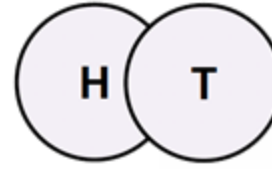
PRESENT AND FUTURE: A POSITION TO BE DISCUSSED!



Separate



Supplementing



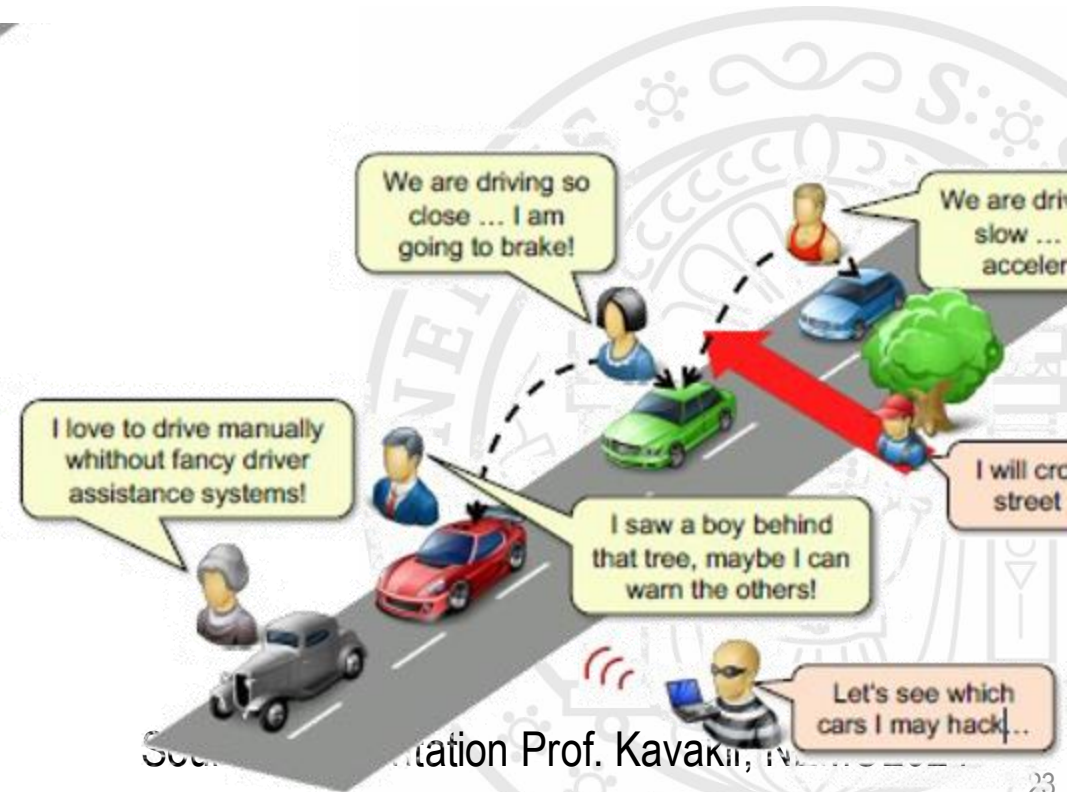
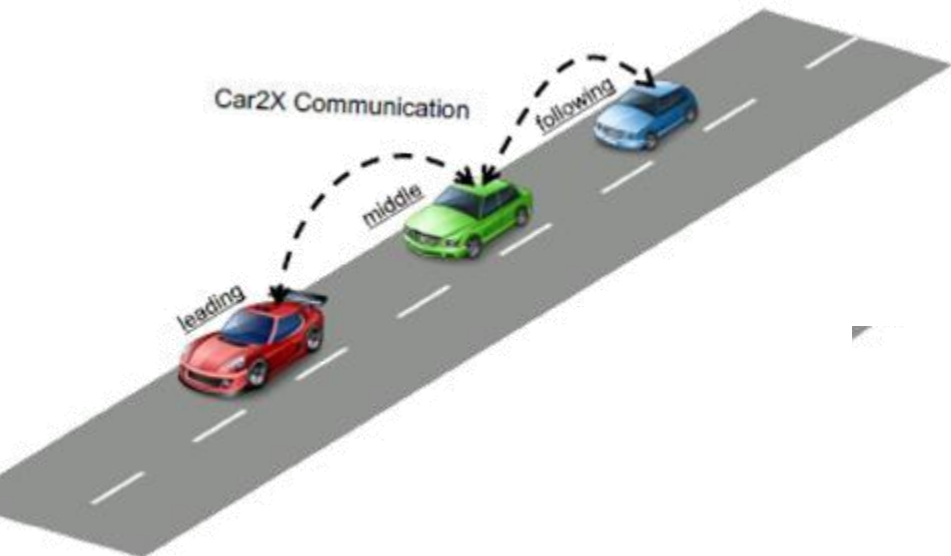
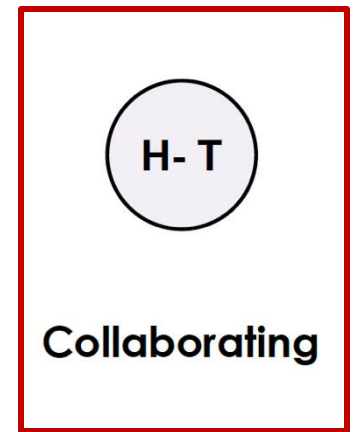
Interdependent



Collaborating

H...Human
T...Technology

PRESENT AND FUTURE: A POSITION TO BE DISCUSSED!



THANK YOU FOR YOUR ATTENTION!



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