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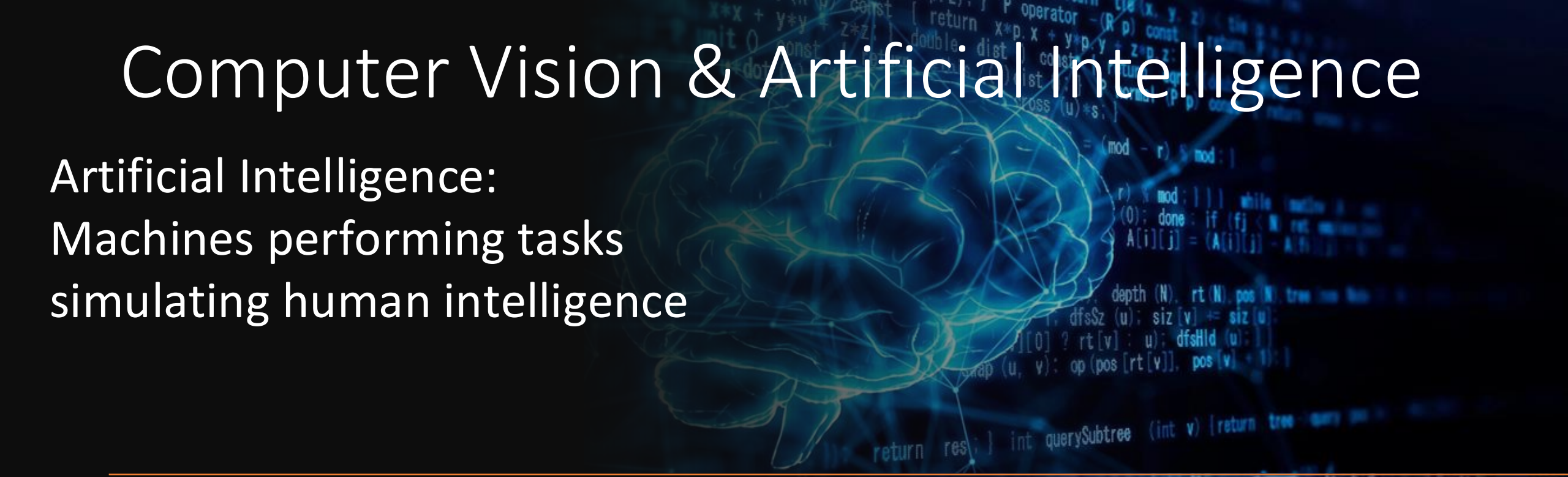
1870

Augmented Reality for Perceptual Task Guidance

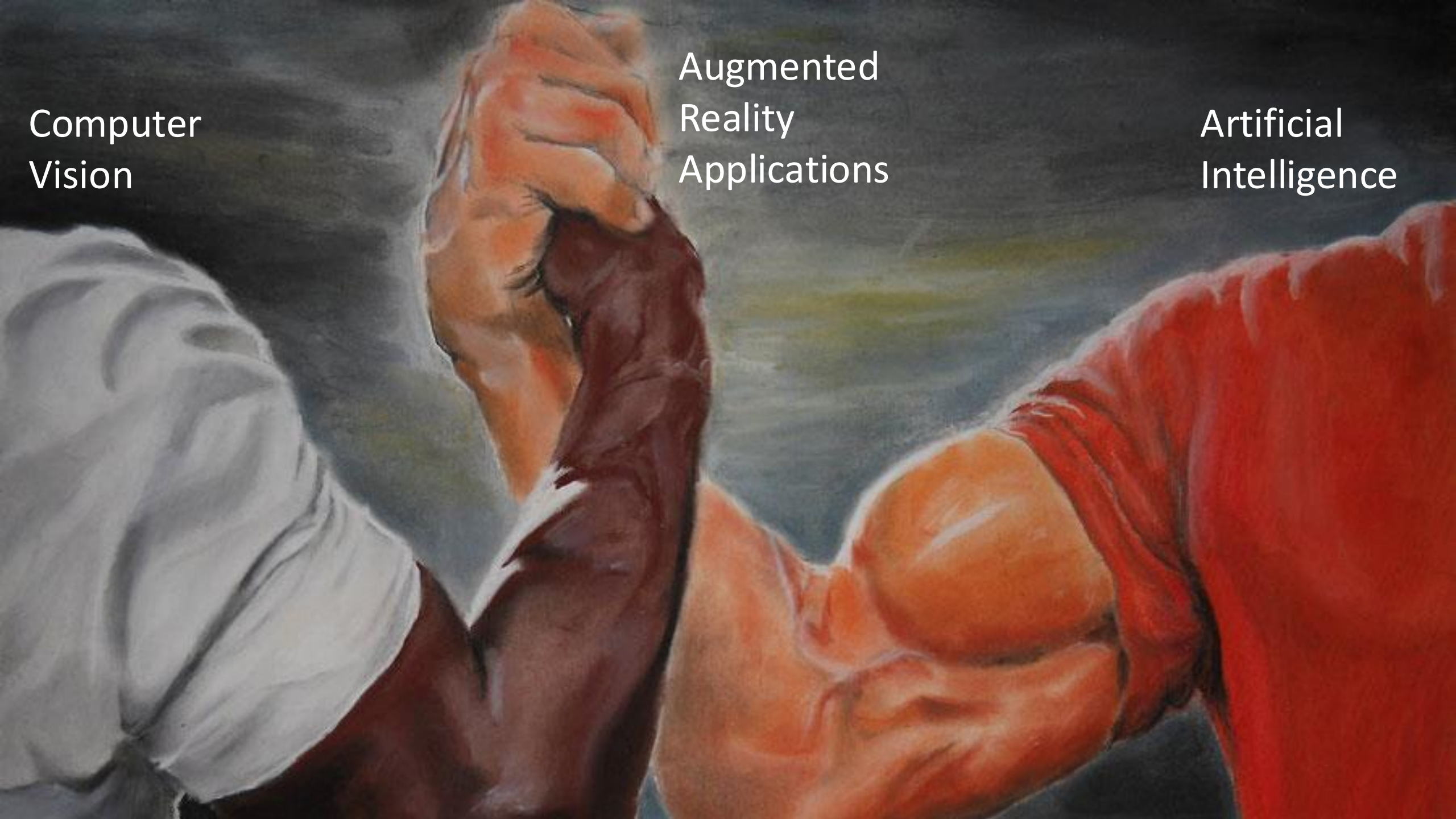
Enrique Dunn

Computer Vision & Artificial Intelligence

Artificial Intelligence:
Machines performing tasks
simulating human intelligence

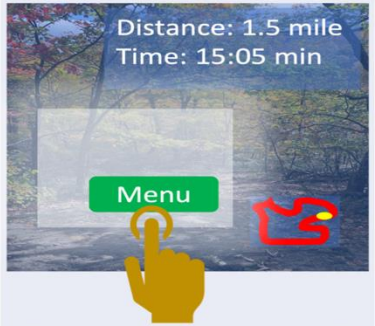


Computer Vision:
Extracting concepts from pixels


Computer Vision
Augmented Reality Applications
Artificial Intelligence

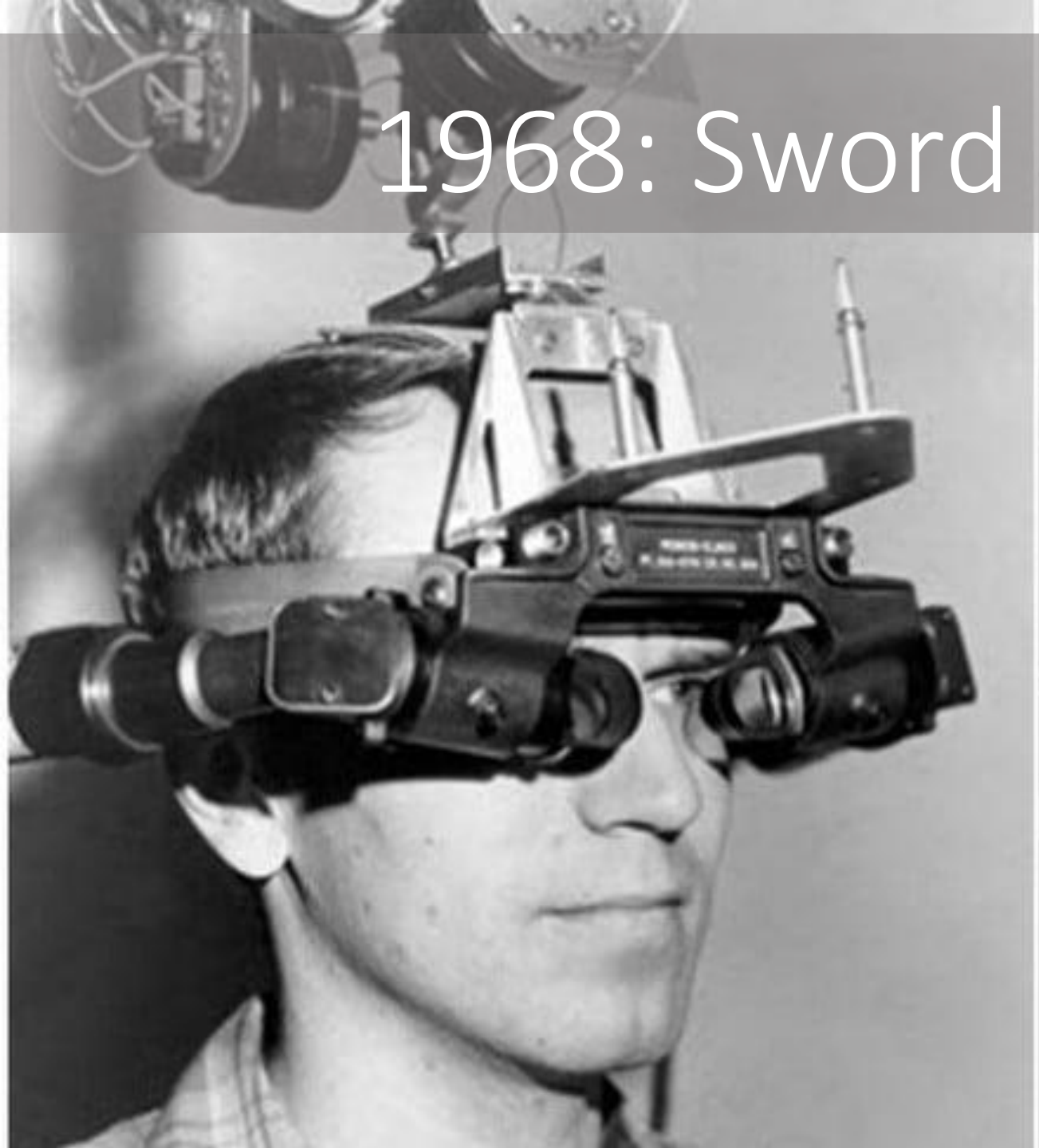

Extended
Reality
VR
XR
AR
Virtual
Augmented

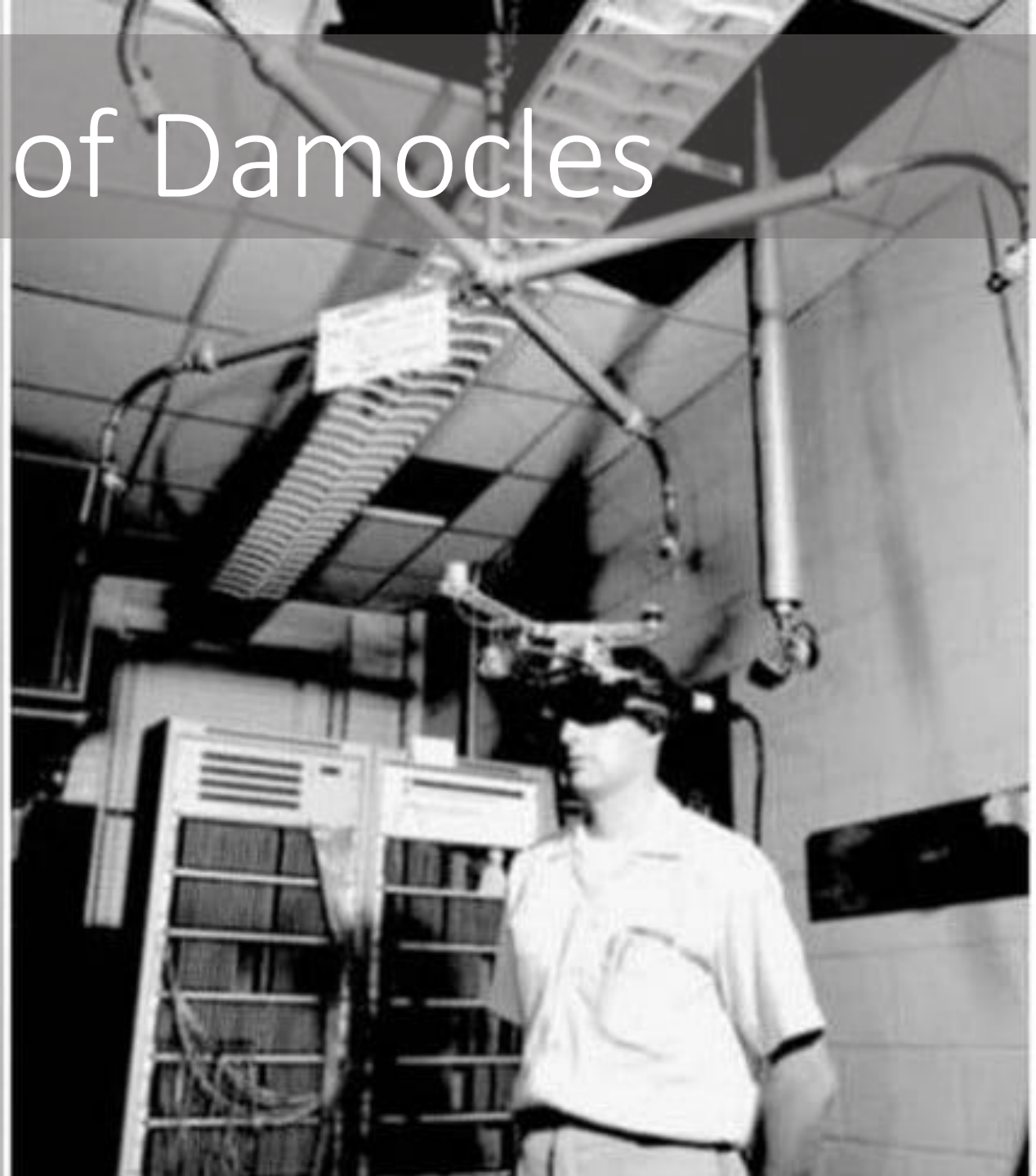
Disentangling the Alphabet Soup…

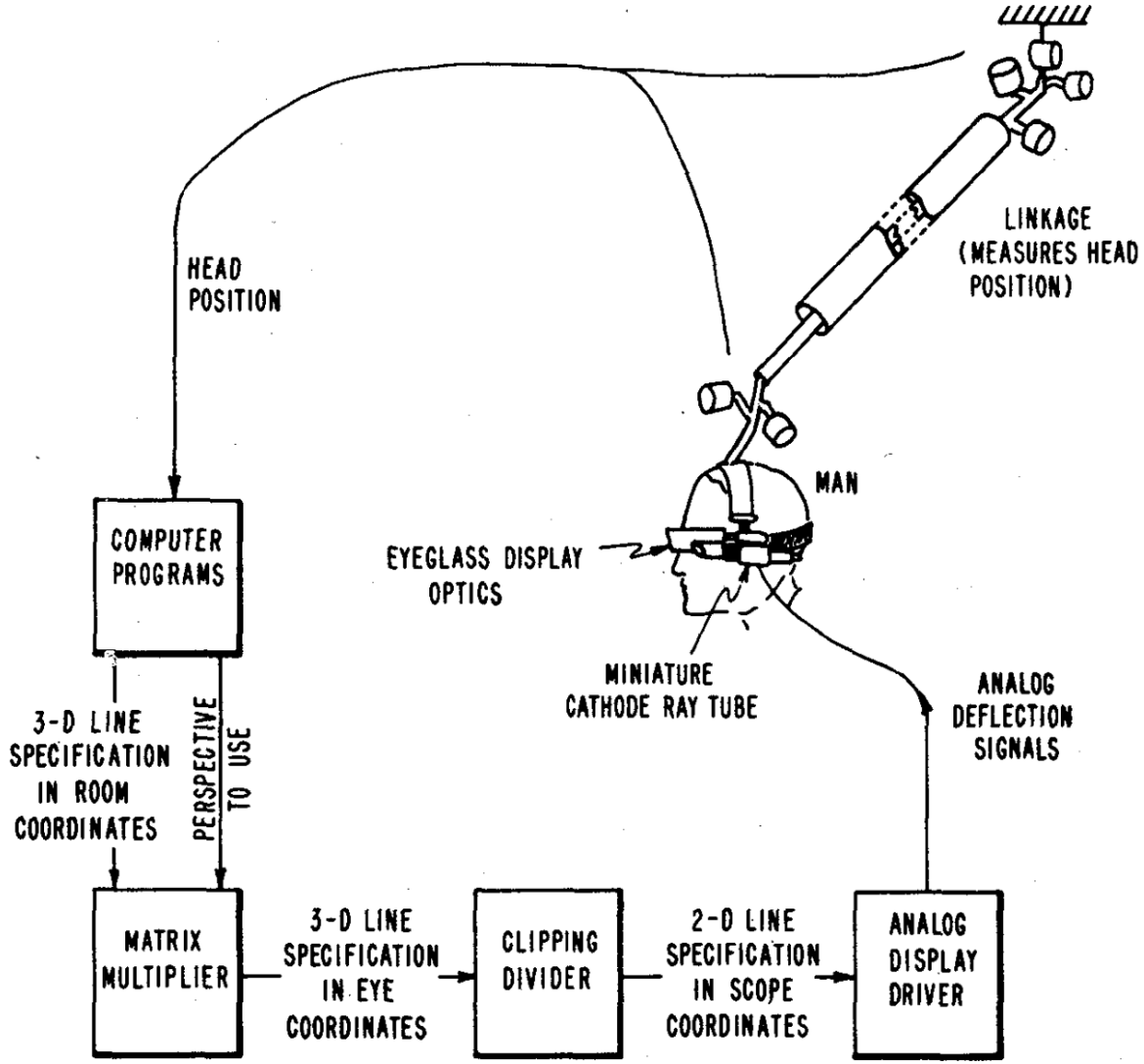
		Extended Reality (XR)		
	Reality	Augmented Reality (AR)	Mixed Reality (MR)	Virtual Reality (VR)
Display	Naked eye/optical glasses	Translucent display	Translucent display	Occlusion display
Display example				
Example	 Real view of a trail	 Augmented virtual map and direction	 Interactive virtual contents	 Virtual gaming

Akyildiz, Ian & Guo, Hongzhi. (2022). Wireless communication research challenges for Extended Reality (XR). ITU Journal on Future and Evolving Technologies (ITU J-FET). 10.52953/QGKV1321.

1968: Sword of Damocles







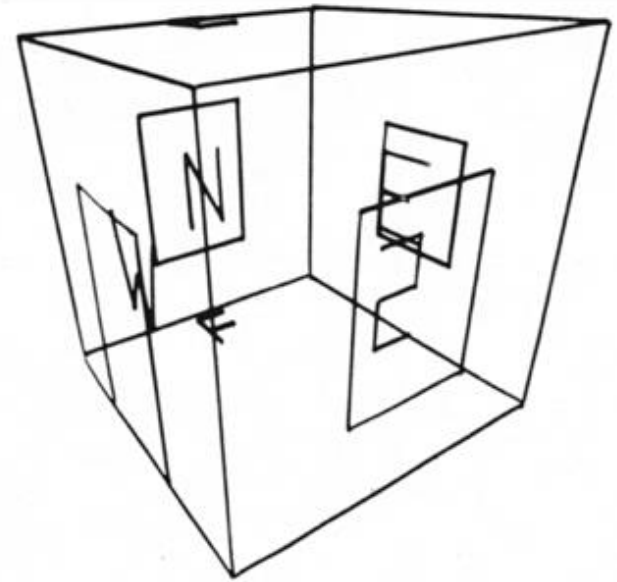


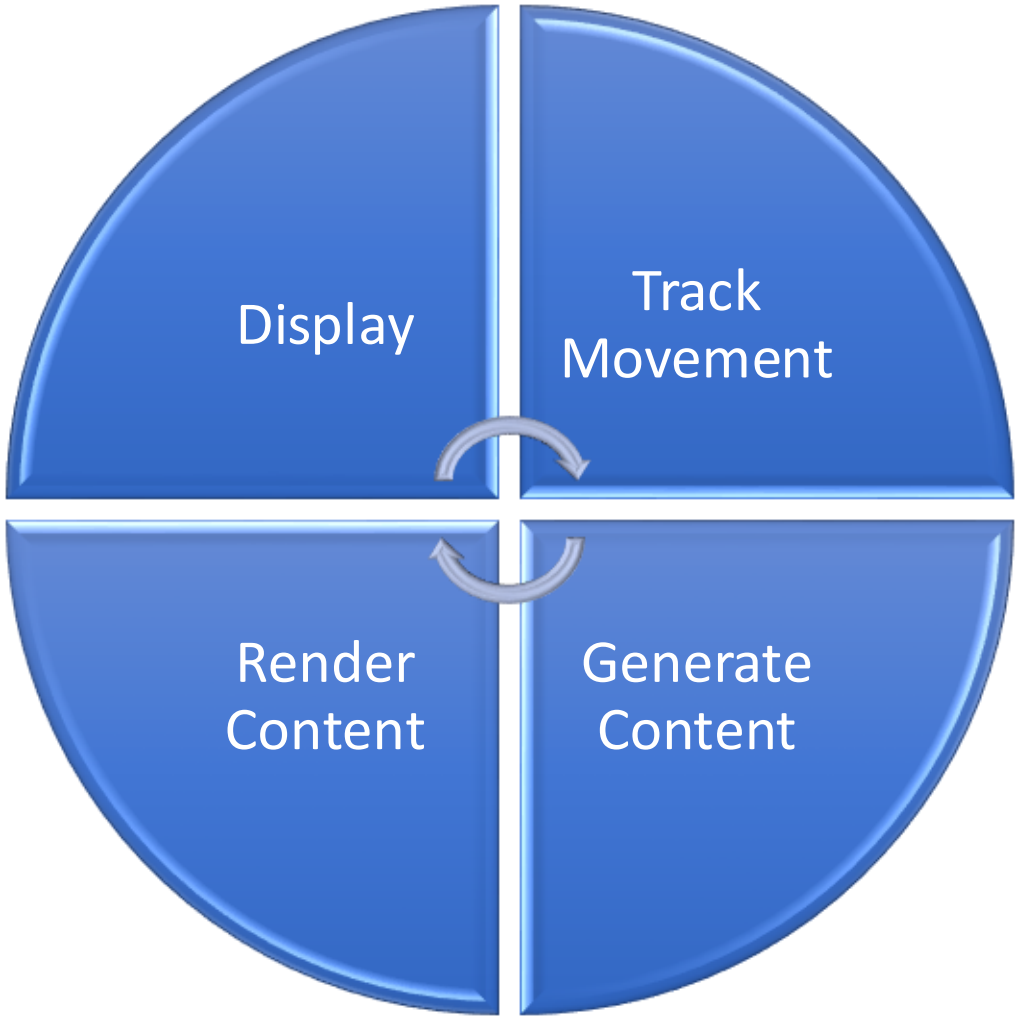
FIGURE 9—A computer-displayed perspective view of the

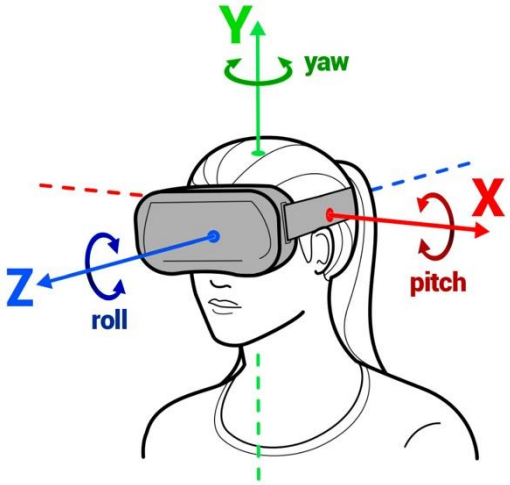
FIGURE 8—A computer-displayed perspective view of the cyclo-hexane molecule


VIRTUAL FIXTURES
(A.R. system - 1992)
Wright Patterson AFB

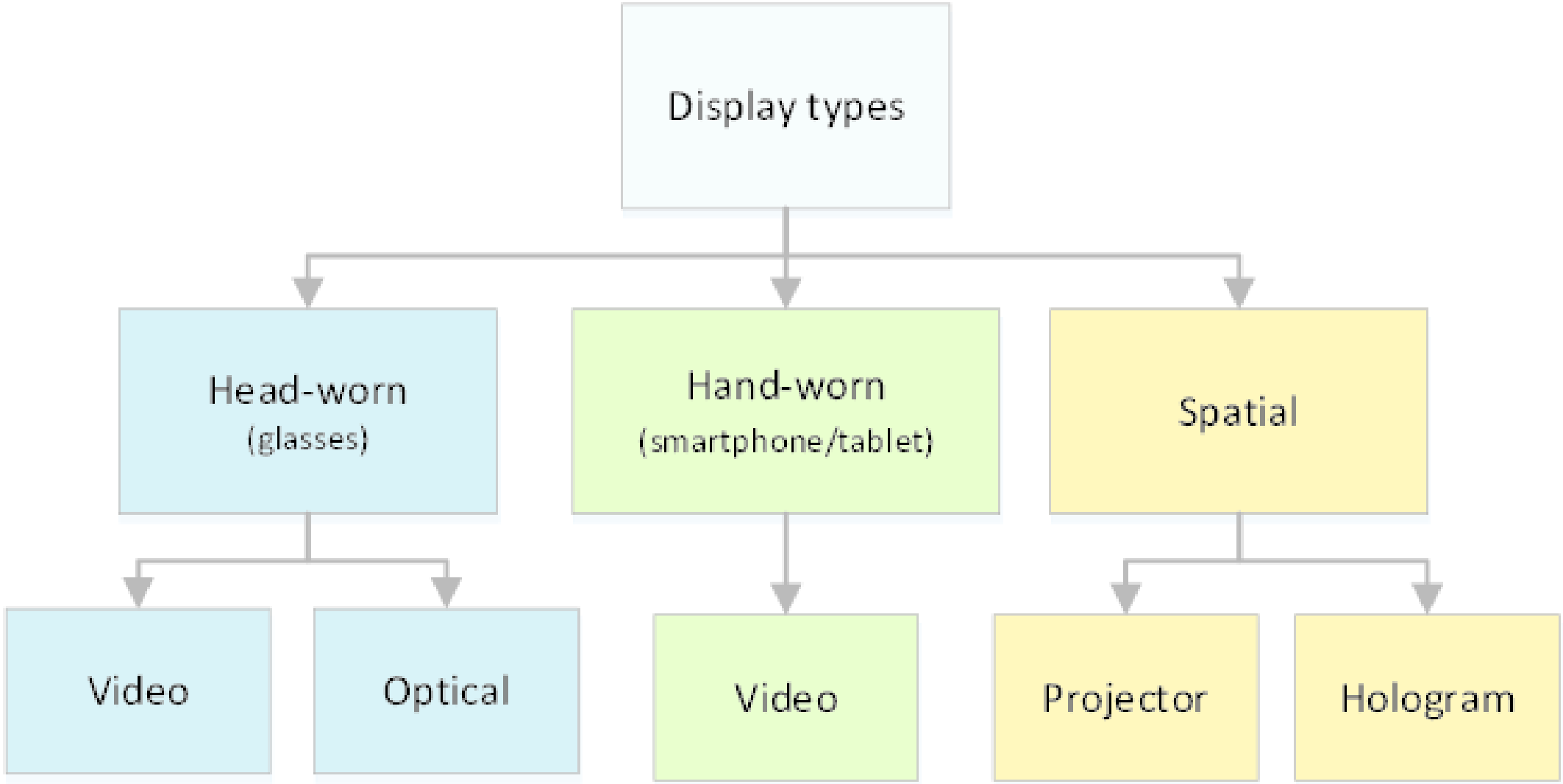

VIRTUAL OVERLAY
WORK SPACE

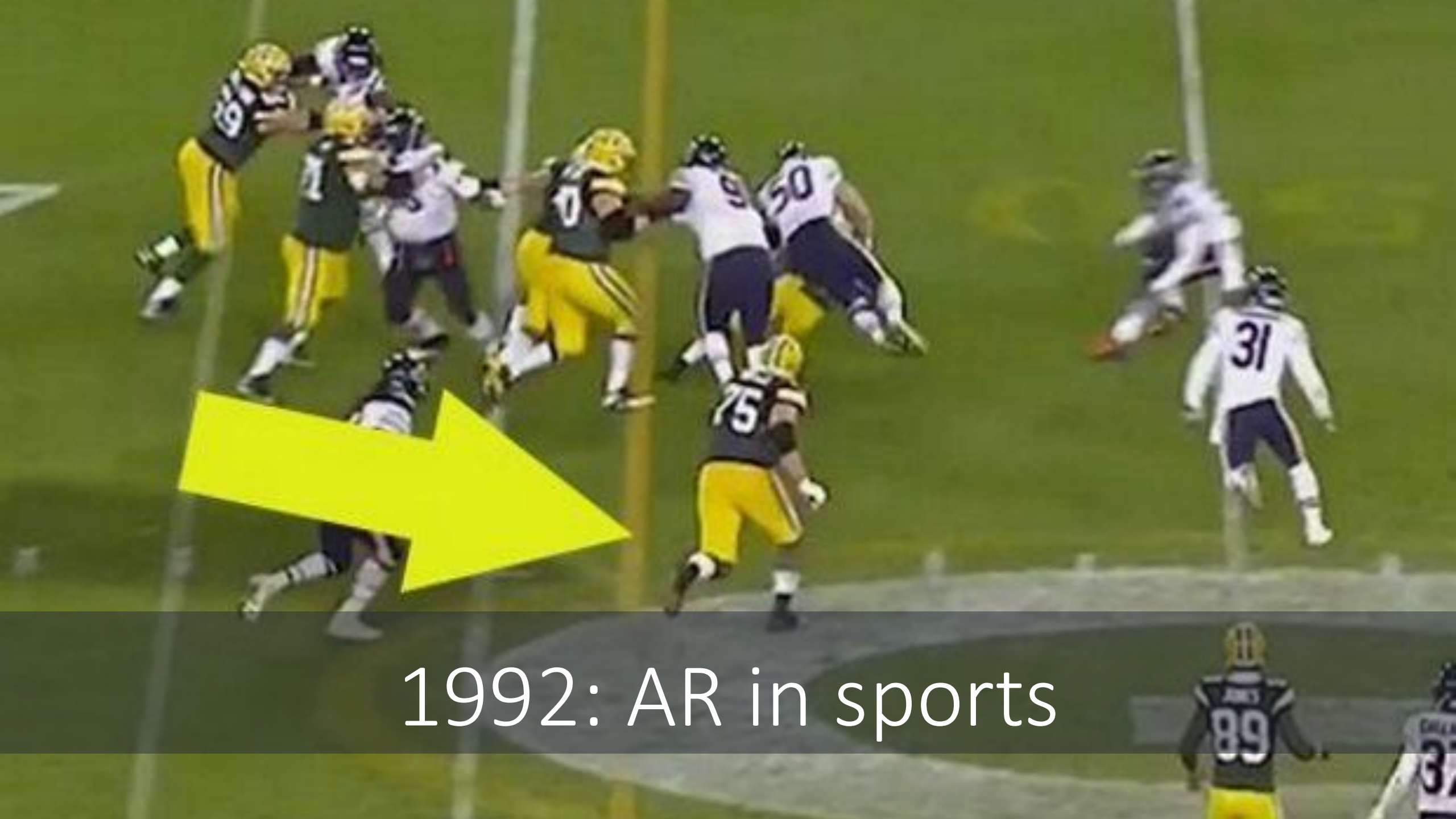
AR/VR Systems





Display Types





1992: AR in sports

2016: Pokemon Go

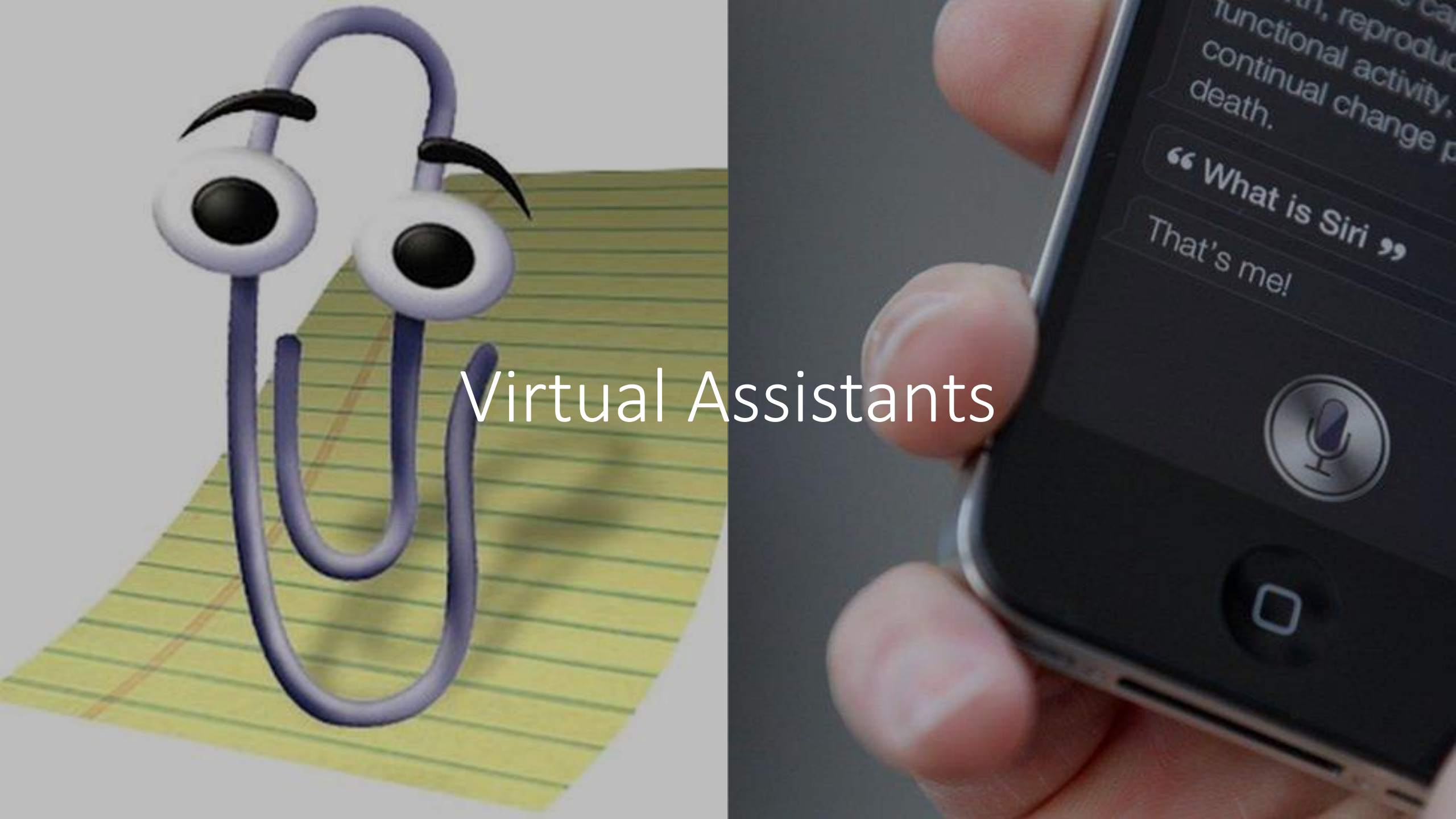
2020: AR state of the art?

2021: VW AR HUD

2023: Apple Spatial Computing

Applications Coming Your Way…

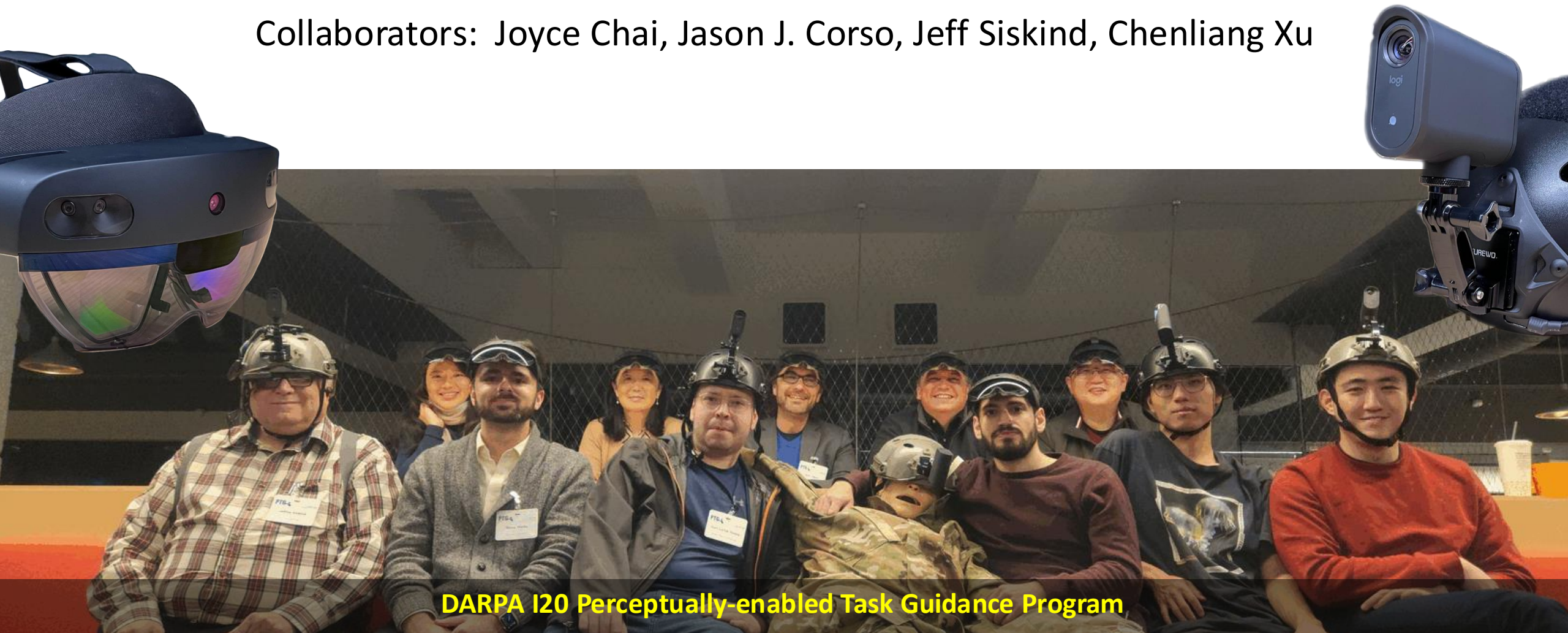
REAL STATE	MANUFACTURING	FASHION
RETAIL	HEALTHCARE	EDUCATION
TRAVEL	MARKETING	ECOMMERCE
MILITARY	SPORTS	TRANSPORTATION



Virtual Assistants

PTG: Perceptual Task Guidance

Collaborators: Joyce Chai, Jason J. Corso, Jeff Siskind, Chenliang Xu



DARPA I20 Perceptually-enabled Task Guidance Program

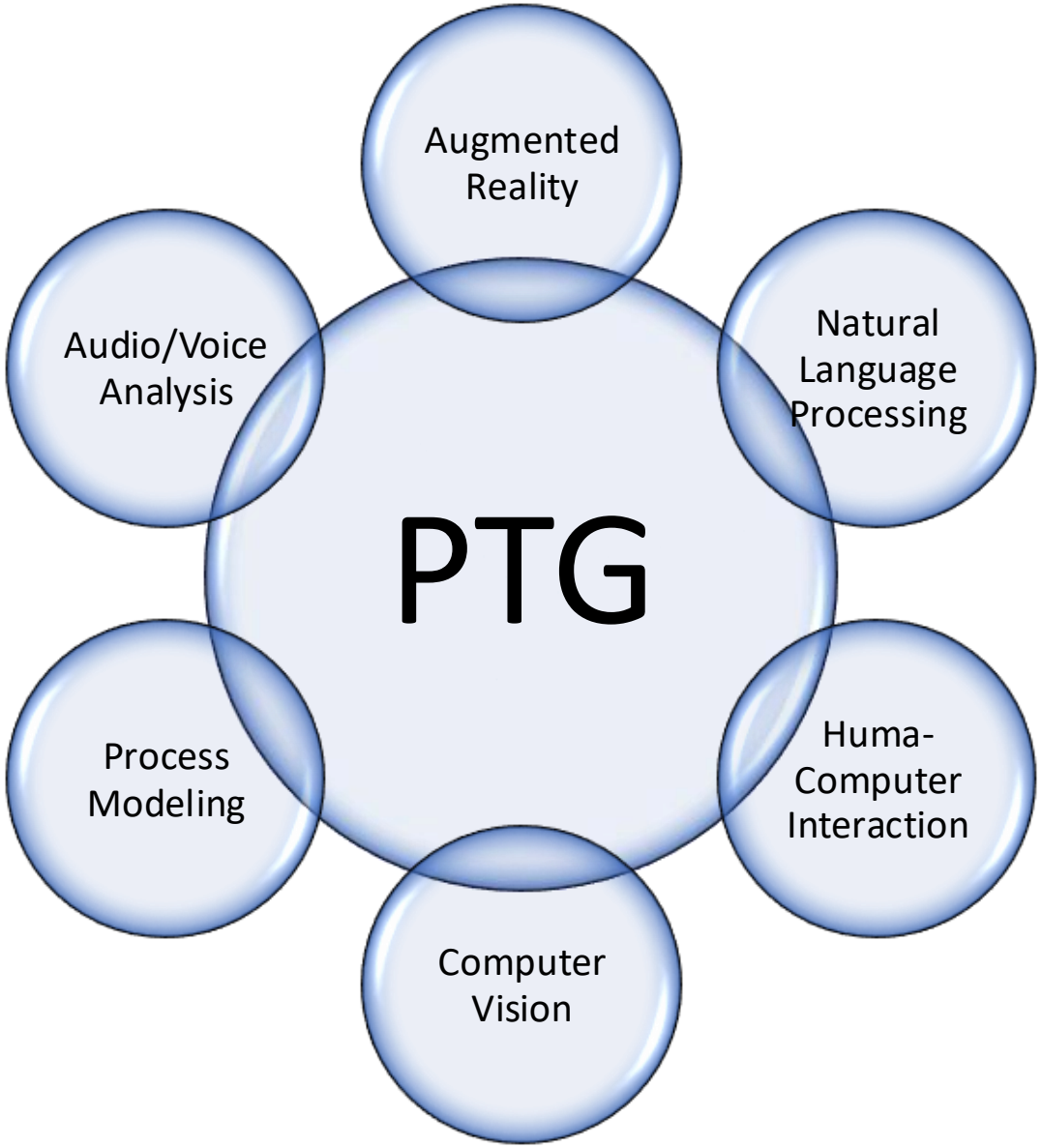
Perceptual Task Guidance

Goal: Build an Augmented Reality Apparatus with Grounded Physical Mapping for Guiding Humans in Tasks

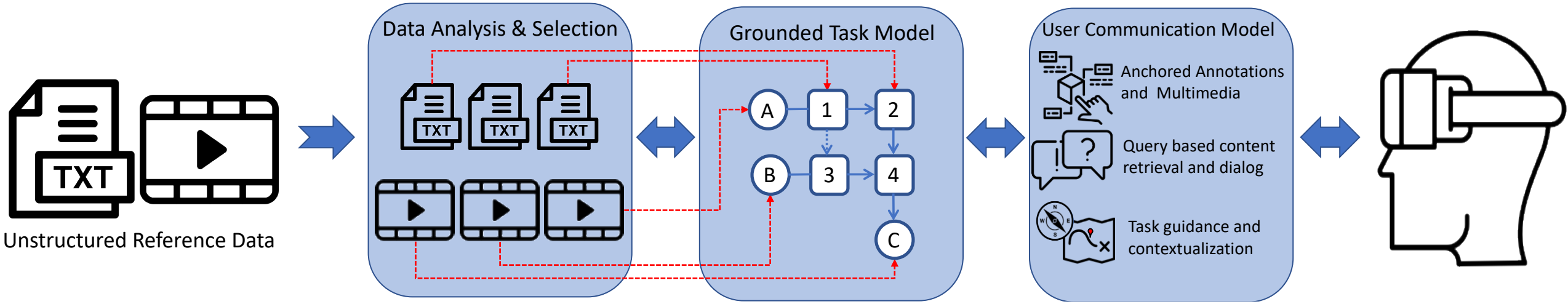
Understand the task, the user and her actions

- Automated
- Interactive/Responsive
- Customizable
- Generalizable

Perceptual Task Guidance



Grounded Communication Model

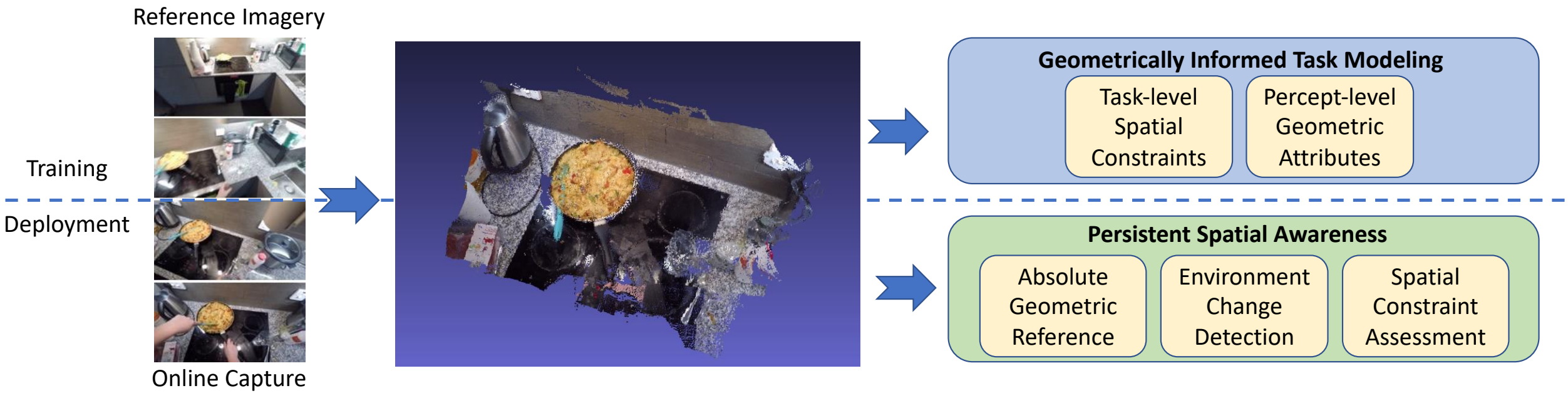


Annotations Anchoring:
Viewport-based
Spatially-based
Object -based

Content Retrieval:
Pertinent
Interactive
Customizable

Guidance:
Convey State
Recommend Actions
Detect Errors

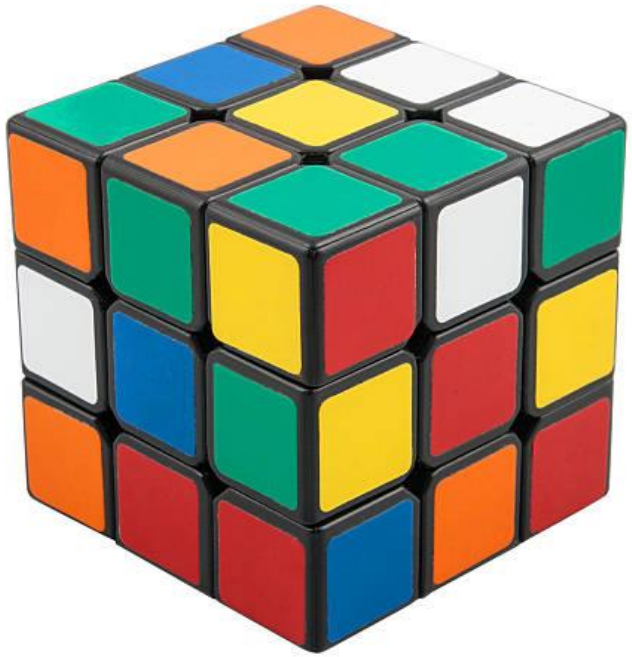
The Role of Perceptual Grounding

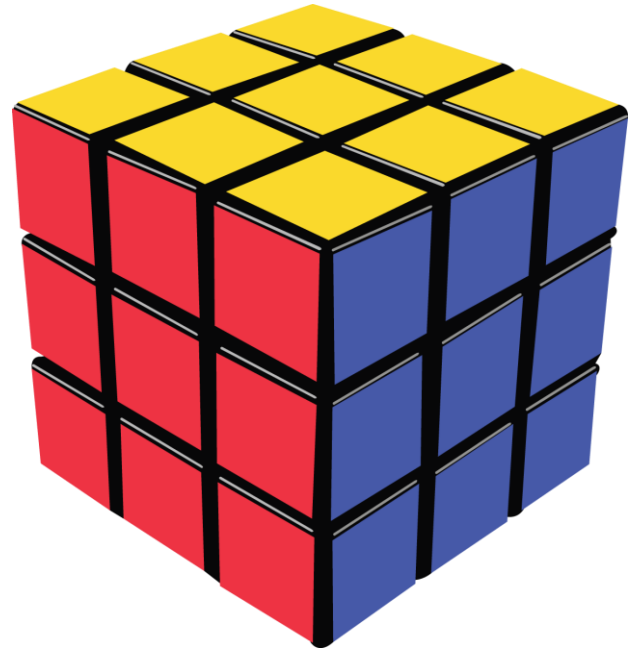


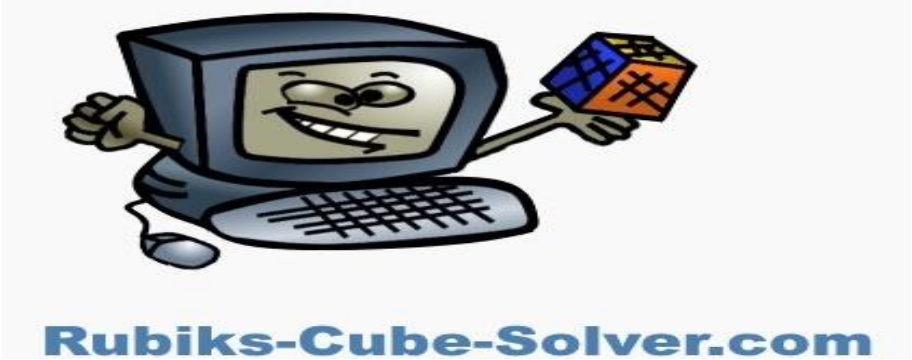
MARCuS: ***M***ulti-modal ***AR CU***be ***S***olver

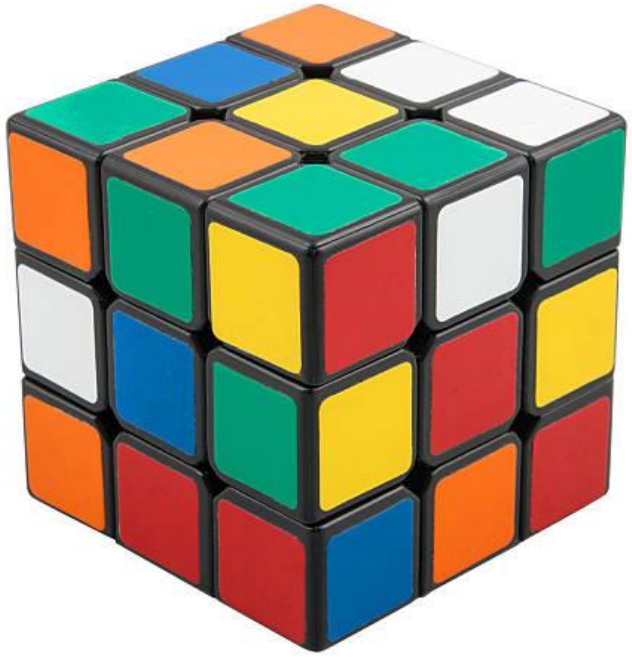
Juan C. Dibene Enrique Dunn

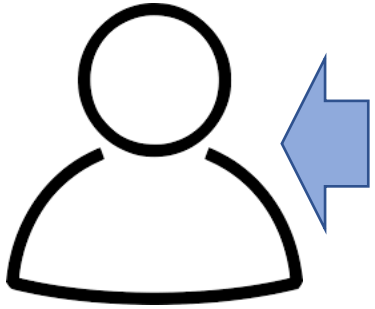
Computer Science Department

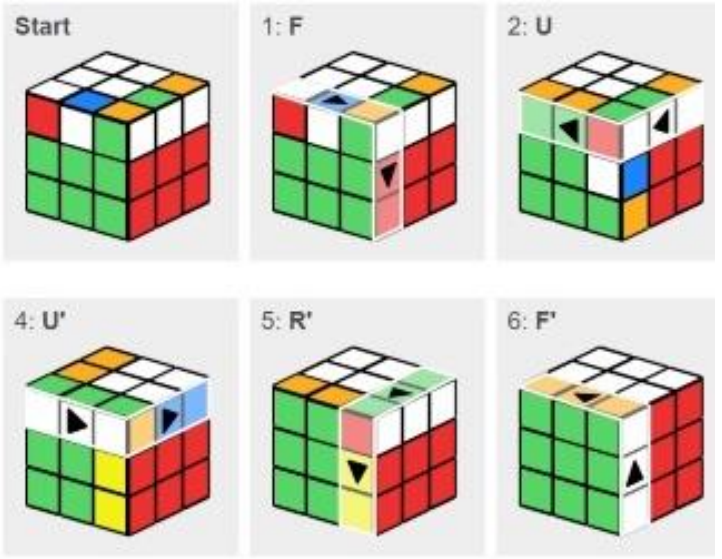


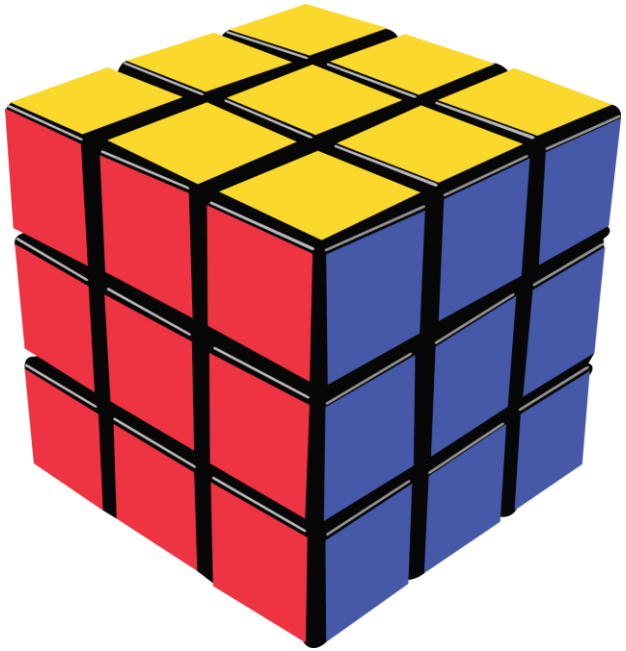






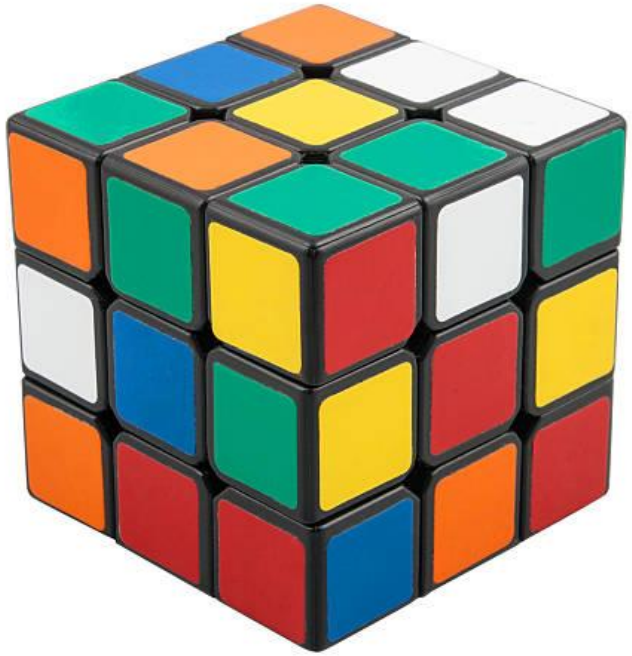






Step 3/3: OUTPUT Move Sequence

INPUT: Configuration → Planning Solution → OUTPUT: Move List



HL2SS + Unity

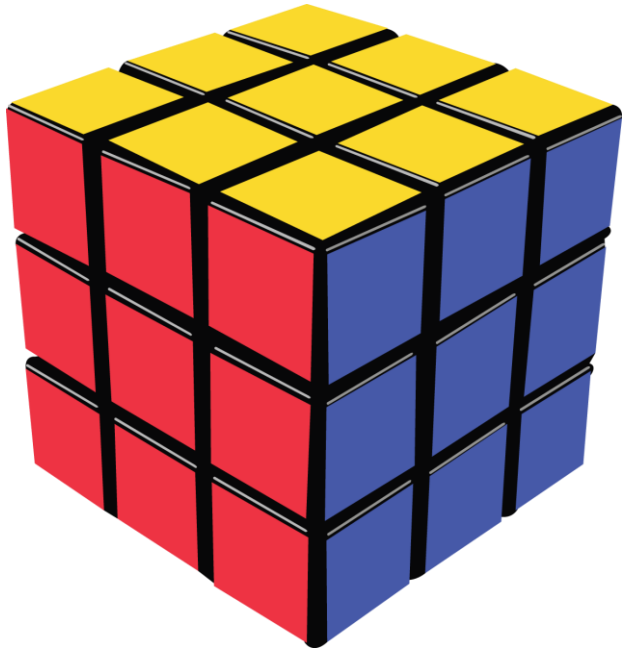
Perception-enabled AR-based UI

Closed Loop (State Verification)

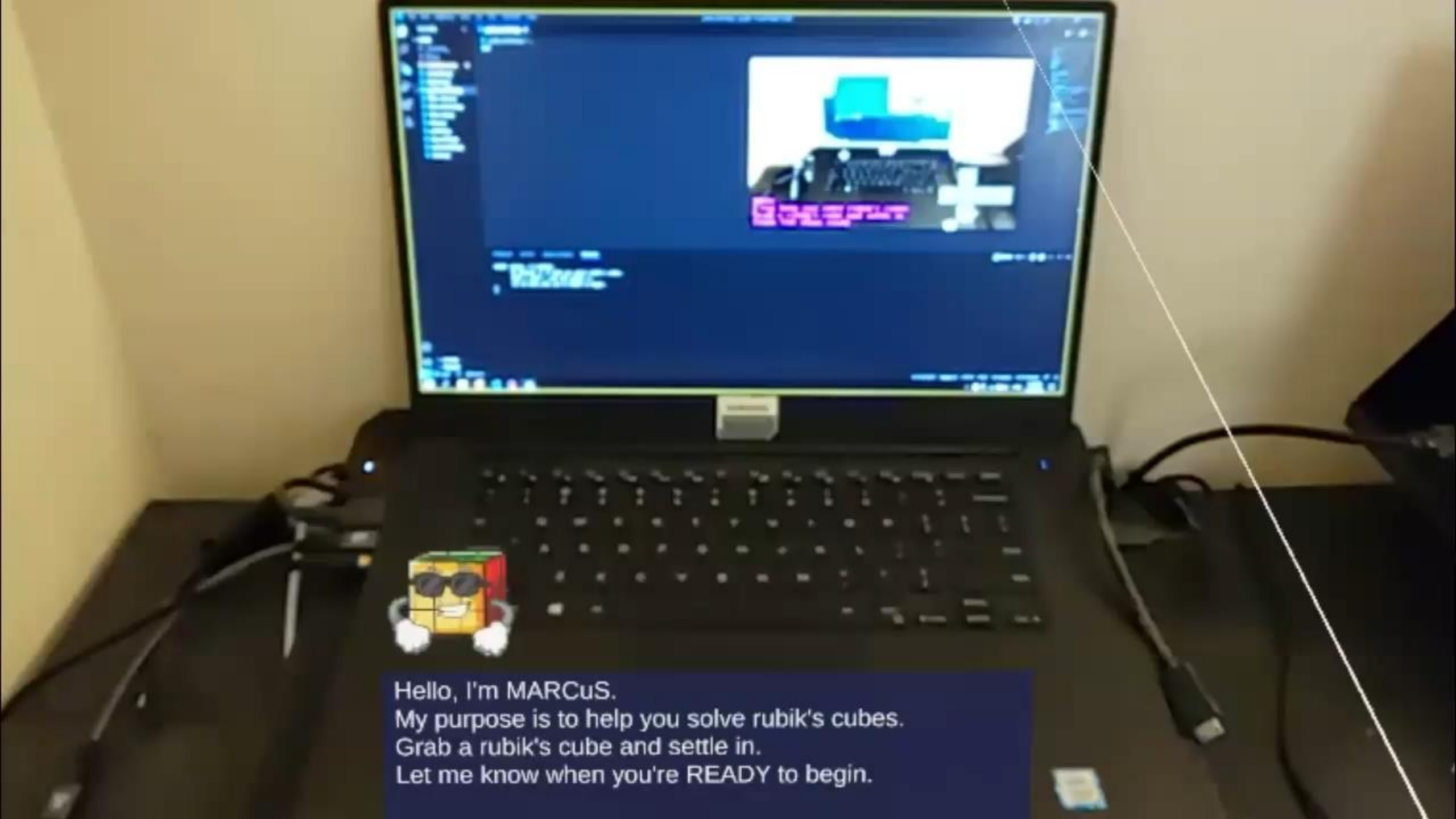
Multimodal (Audio – Visual)

Spatial Guidance (Adaptive Visuals)

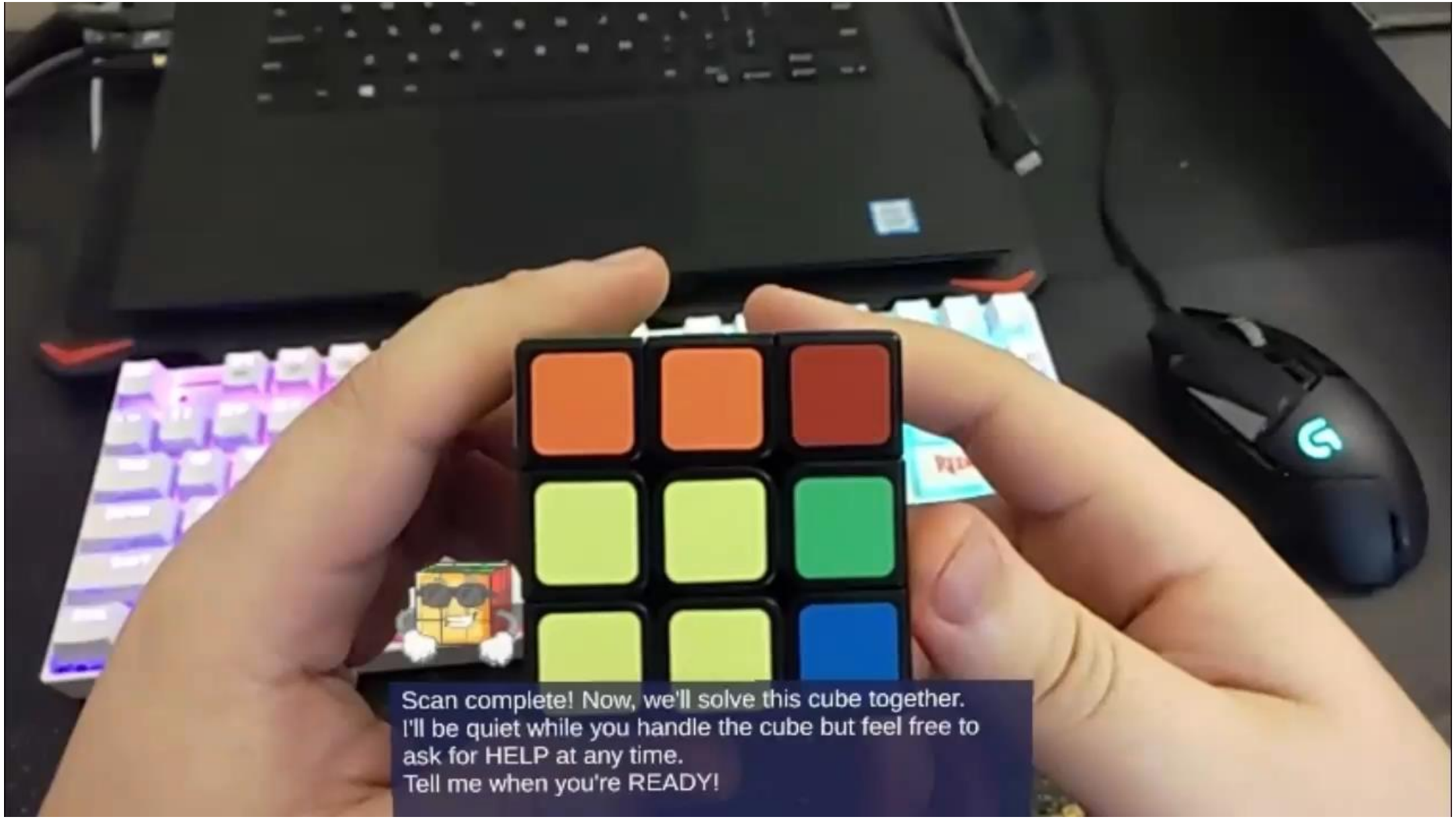
MARCuS In Action…



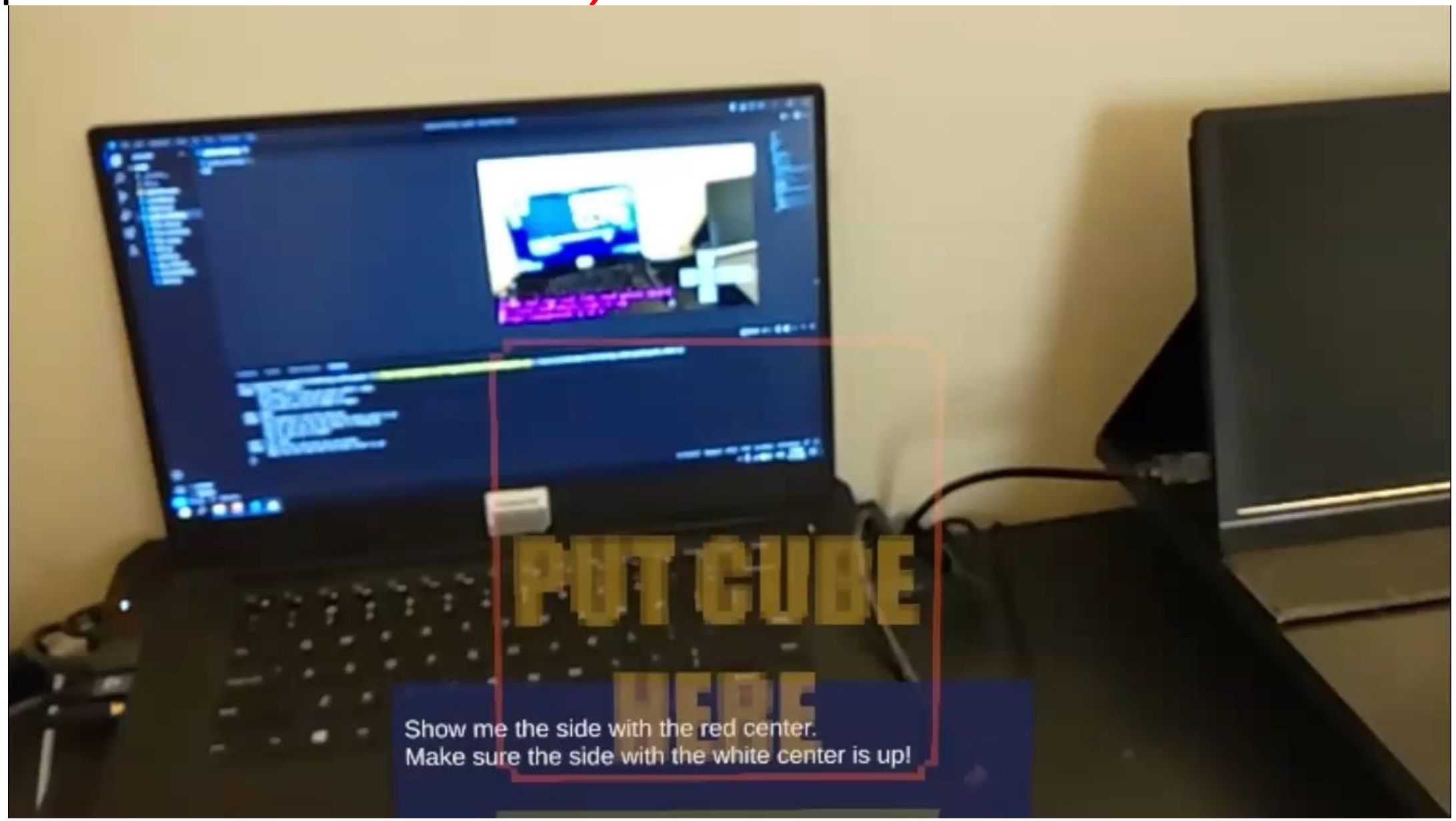
SCAN Configuration → Planning Solution → GUIDE User Moves


Hello, I'm MARCuS.
My purpose is to help you solve rubik's cubes.
Grab a rubik's cube and settle in.
Let me know when you're READY to begin.

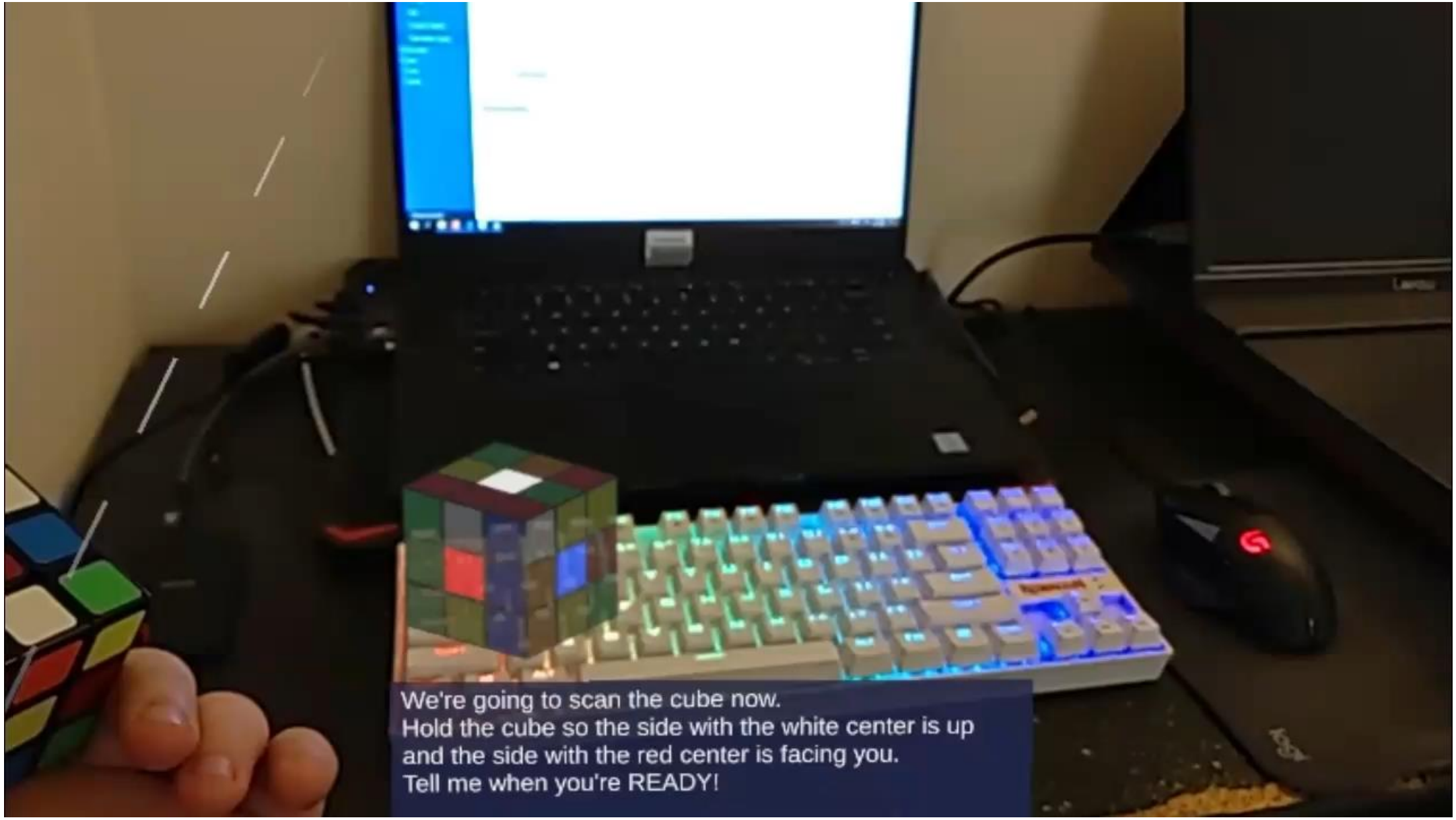
Special Case: *Detecting Move Errors*



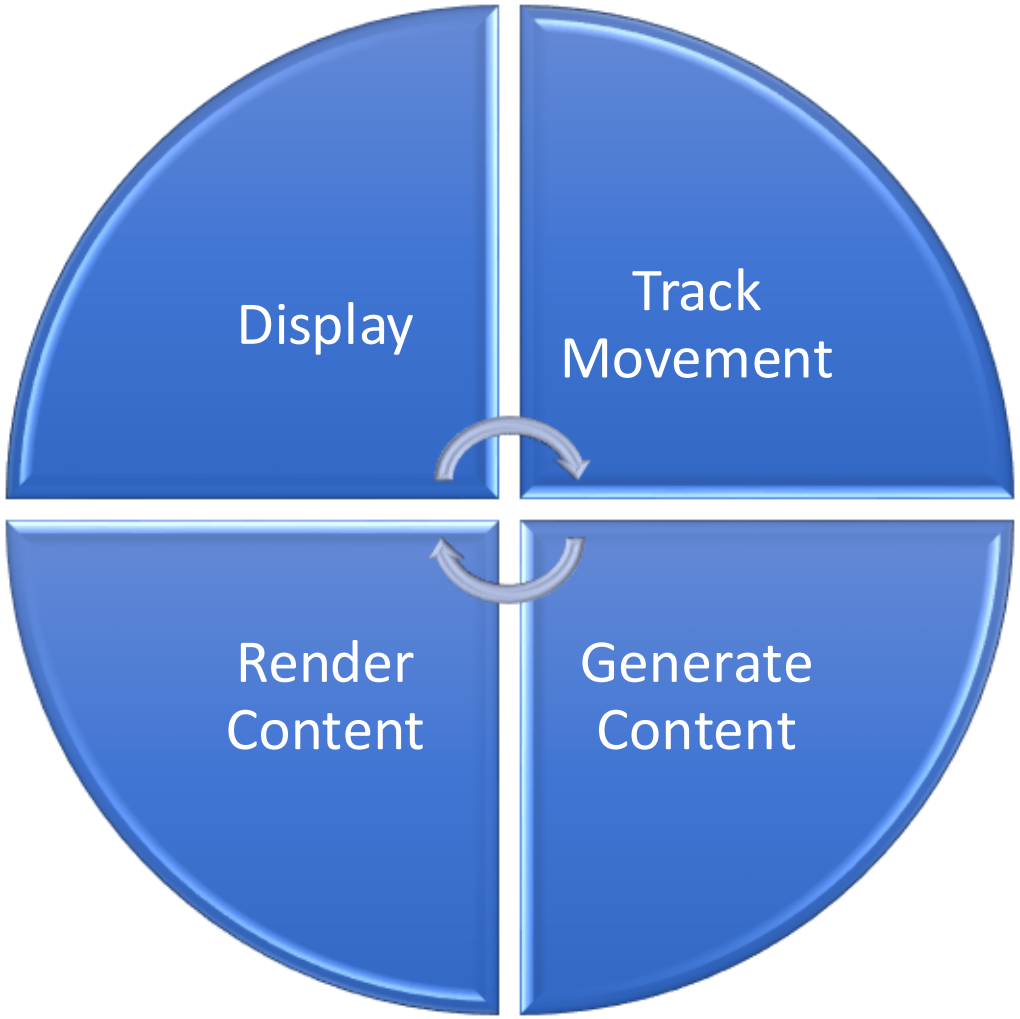
Special Case: *Already Solved*

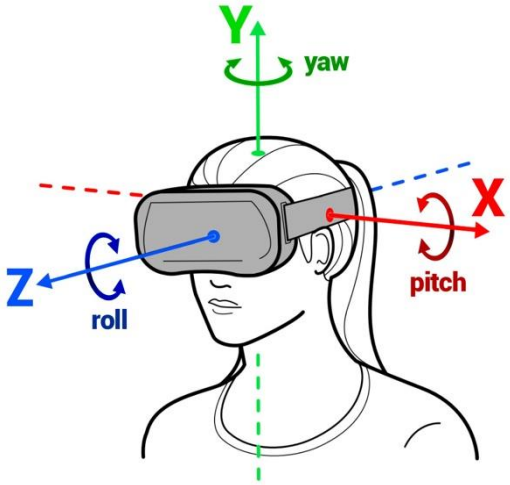


Special Case: *Bad Scan*

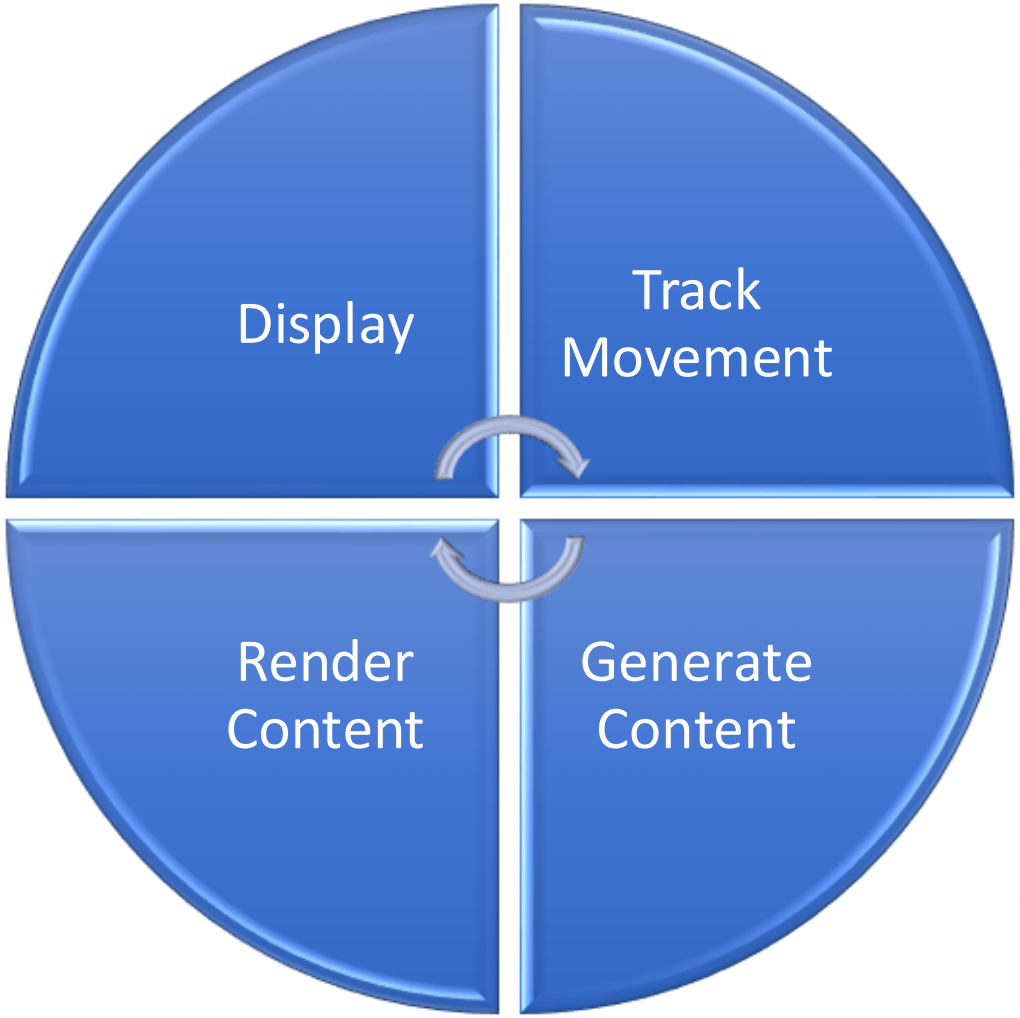


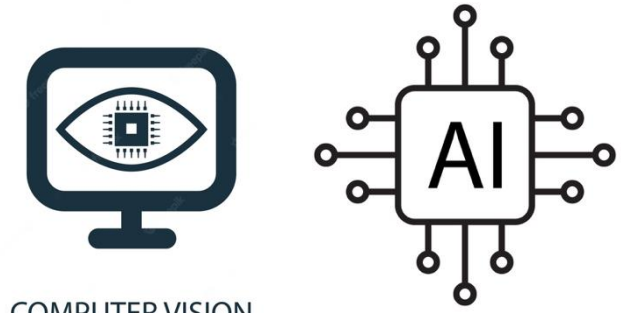
AR/VR Systems





Going Forward





Advances in Neural Rendering

A. Tewari[1⋆] J. Thies[2⋆] B. Mildenhall[3⋆] P. Srinivasan[3⋆] E. Tretschk[1] Y. Wang[4] C. Lassner[5] V. Sitzmann[6] R. Martin-Brualla[3]
S. Lombardi[5] T. Simon[5] C. Theobalt[1] M. Nießner[7] J. T. Barron[3] G. Wetzstein[8] M. Zollhöfer[5] V. Golyanik[1]

[1]MPI for Informatics [2]MPI for Intelligent Systems [3]Google Research [4]ETH Zurich [5]Reality Labs Research
[6]MIT [7]Technical University of Munich [8]Stanford University ⋆Equal contribution.

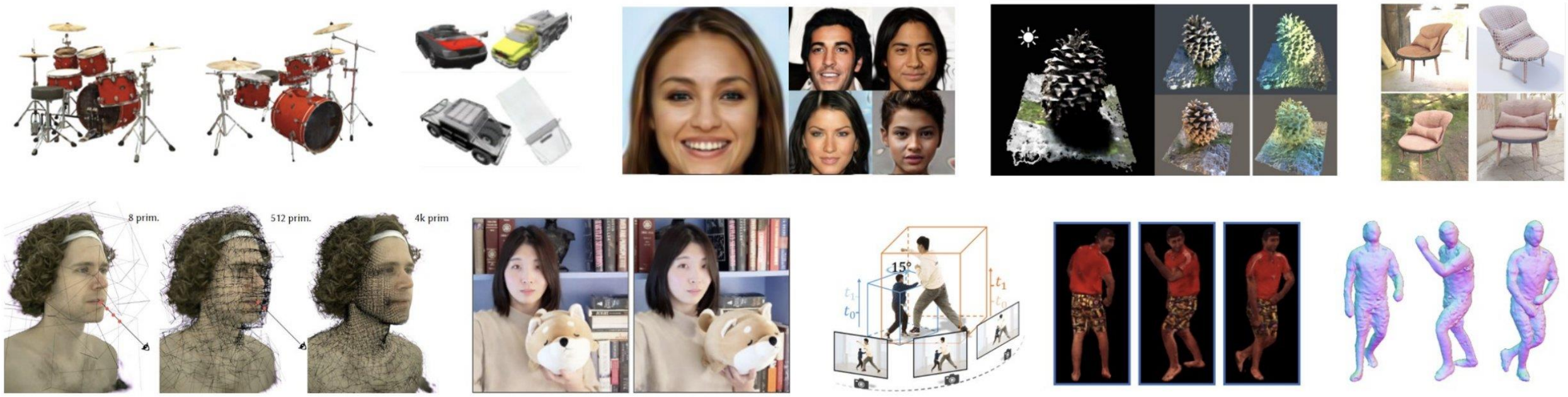


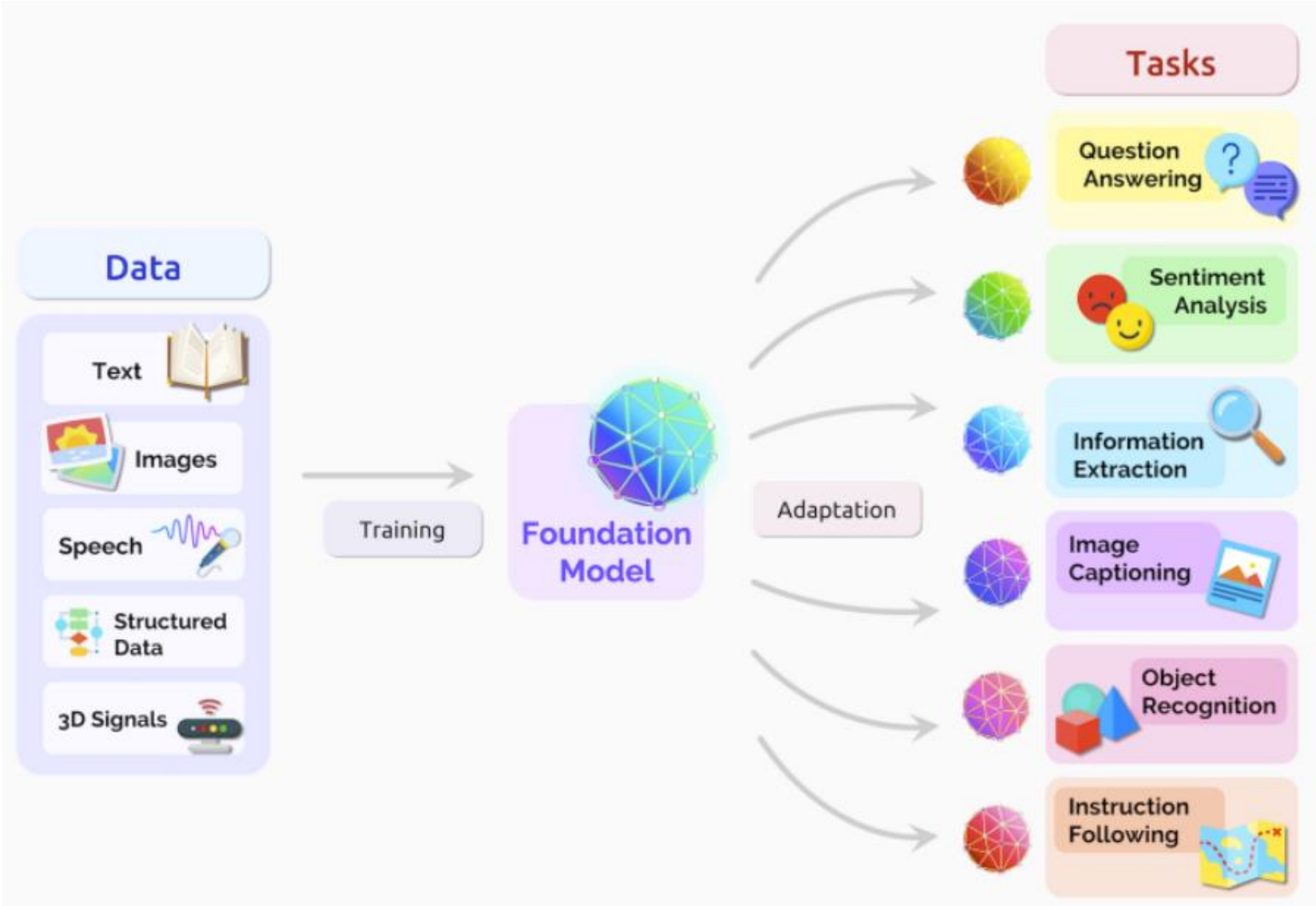
Figure 1: This state-of-the-art report discusses a large variety of neural rendering methods which enable applications such as novel-view synthesis of static and dynamic scenes, generative modeling of objects, and scene relighting. See Section 4 for more details on the various methods. Images adapted from [MST*20, TY20, CMK*21, ZSD*21, BBJ*21, LSS*21, PSB*21, JXX*21, PDW*21].

Generative AI: An astronaut riding a horse

Generative AI: Teddy bears working on new AI research on the moon in the 1980s

Generative AI: Homer Simpson in Psycho

Foundational Large Language Models



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THANK **YOU**

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