



Compassionate, Safety-aware, Creative Physical AI for Human-Robot Collaboration

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Robots with Physical AI to solve real-world problems



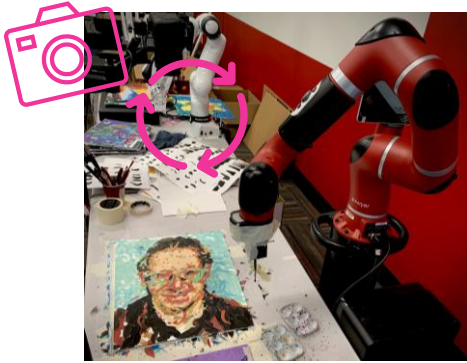
Why arts?

1. To study research questions on the purest, least applied problems

Art is like Math.

Promoting collaborative robotics research

Semantic Perception



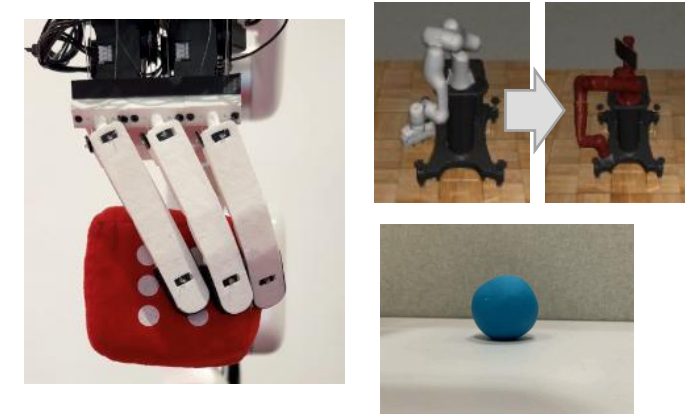
Learning & Control



Planning



Dexterous manipulation



Generative AI



"Frida Kahlo & a red robot"

Simulation to Real gap



Multimodal HRI



Responsible AI
Data bias
Social awareness



GenAI vs. Robotics: a portrait of van Gogh

- ChatGPT

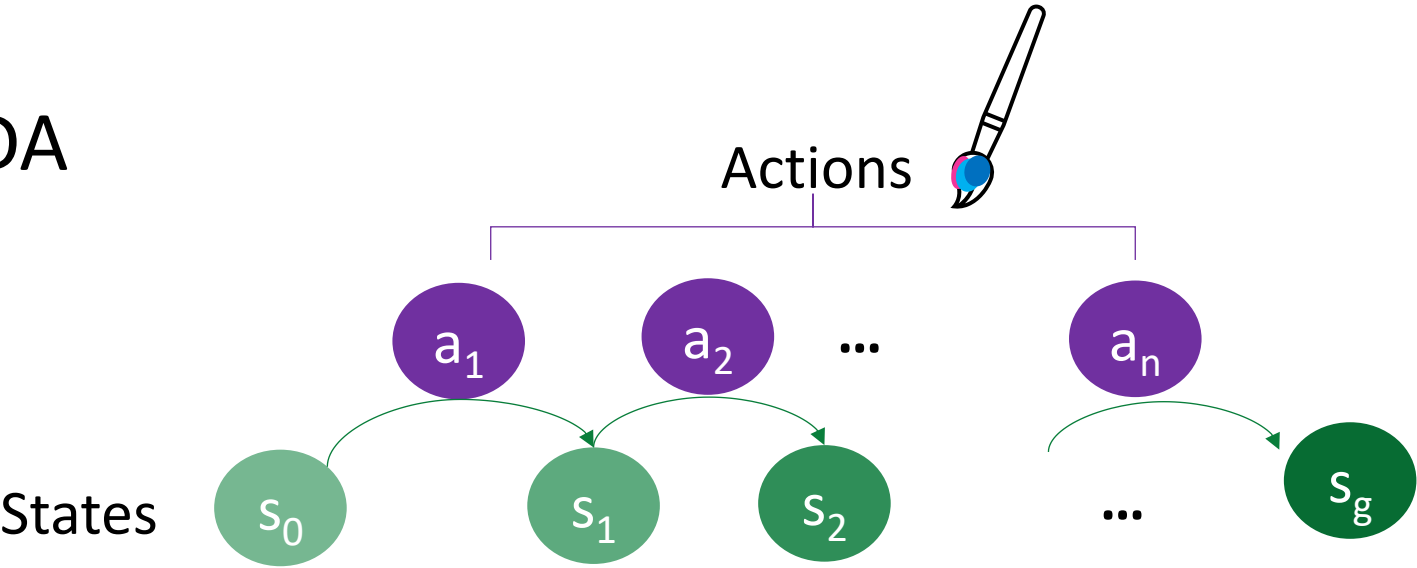


GenAI vs. Robotics: a portrait of van Gogh

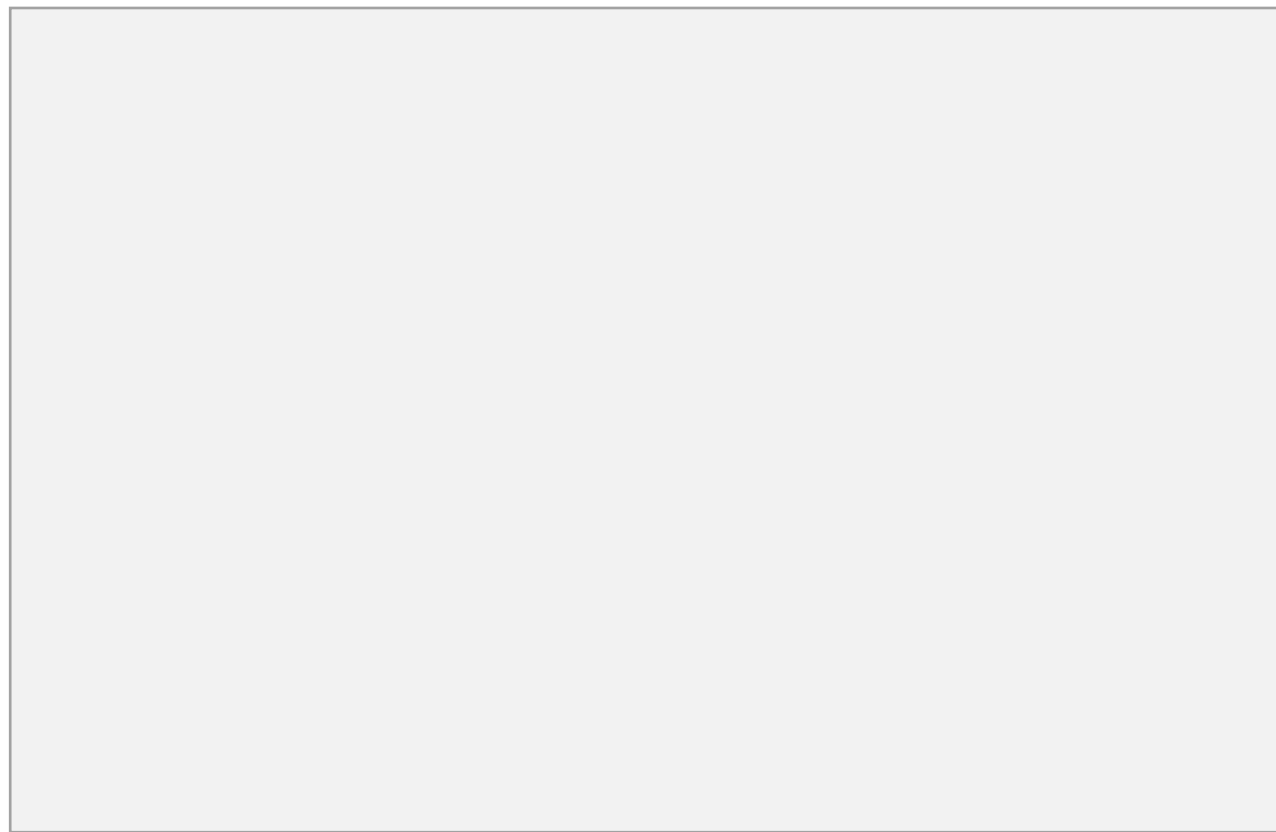
- ChatGPT



- FRIDA

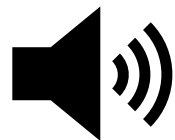


What do you want to paint with FRIDA?

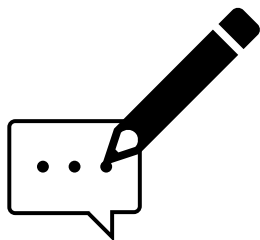


How do we [humans] describe what we want?

Planning with abstract goals



Tone/Sound



Language



Drawing



Examples



Planning with abstract goals requires **Creativity**
Compassion

Multimodal Interaction

Language

Sound

Image

Gesture

...



Reducing Simulation-to-Real Gap



Peter Schaldenbrand

Target
Image



Sim.



Paint Colors



Real



Reducing Simulation-to-Real Gap

Target Image



Huang et al.
2019 [16]



Schaldenbrand & Oh
2021 [21]



[ICRA'23]
(proposed)



Spline-FRIDA
[RAL'25]



Sim.

Paint Colors



Real



$\Delta = 0.156$

$\Delta = 0.066$

$\Delta = 0.029$



Physical Constraints



Vihaan Misra



Physical Constraints

Prompt

"Using only the objects in the image, make a tree. Do not add anything."

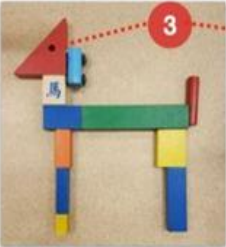
"Recombine existing image elements to create a crown. No new parts."

"Rearrange visible objects in the image to depict a horse. No new content"

"You are a sculptor using only the objects in the image. Build a teapot from them."



Input Image

ChatGPT	InstructPix2Pix	SORA : GenAI	
			1 Hallucinates objects
			2 Changes colors; invents golds/jewels
			3 Adds eyes/tail
			4 Does not match target concept



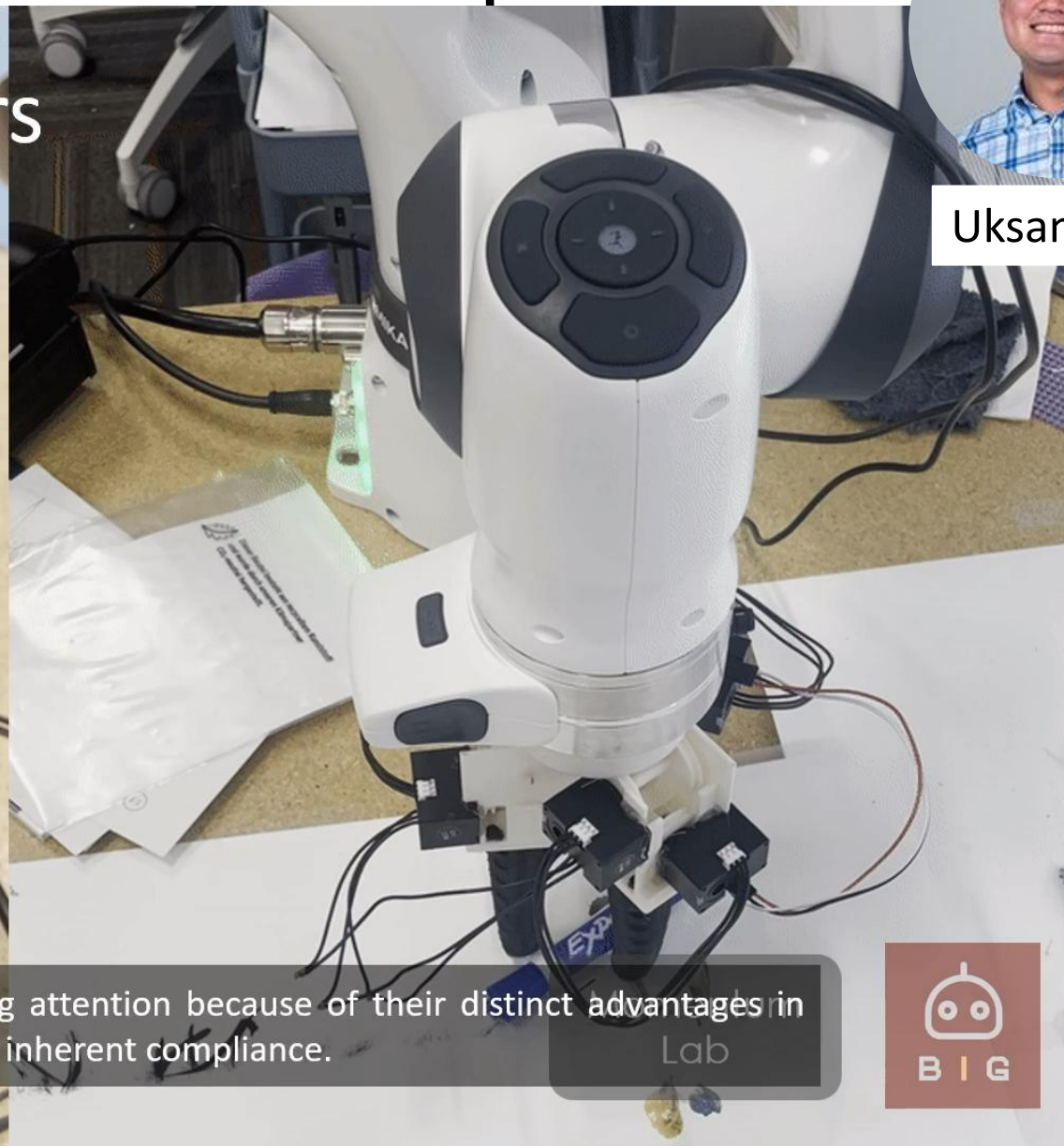
Preserves object geometries; matches target concept

Safety-aware Contact-rich Manipulation



Uksang Yoo

Soft Robotic End-effectors

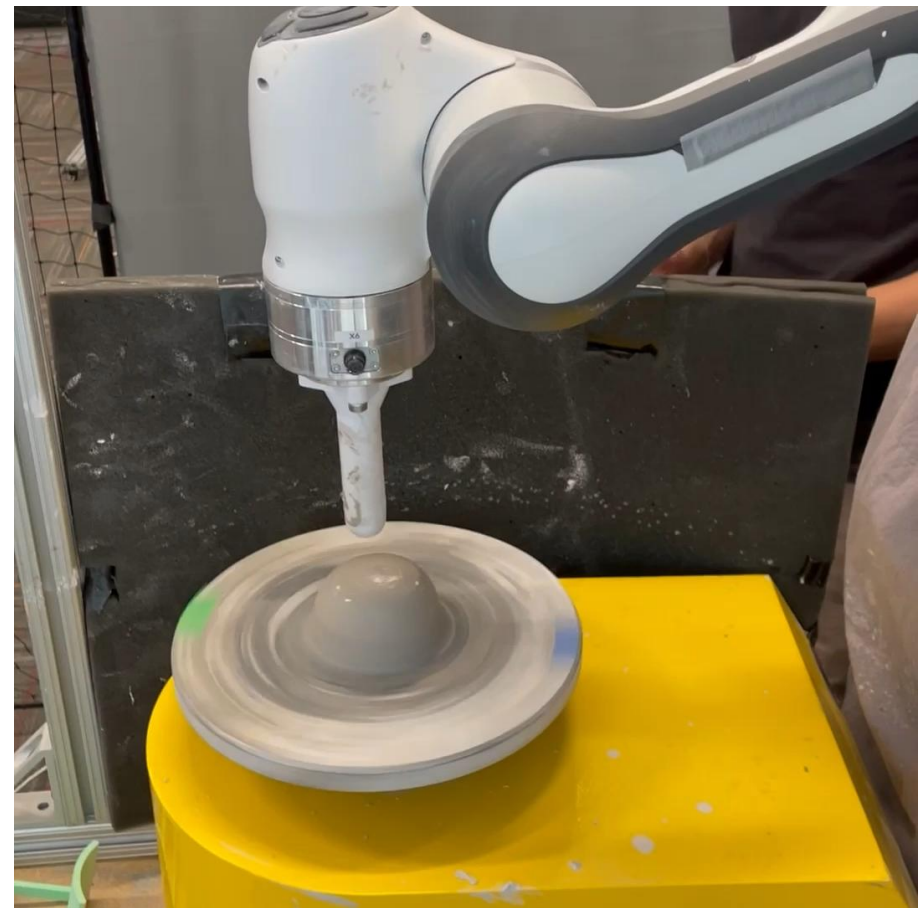


Soft robotic end-effectors are garnering attention because of their distinct advantages in delicate manipulation tasks due to their inherent compliance.

Lab



Manipulation Research to Art



[Best Oral Presentation Award Finalist, Humanoids'24]

Soft Black Box: Explainability



Hyun Parke



Uksang Yoo



[ICRA'25 Arts in Robotics Exhibition]



Why arts?

2. To promote real-world human values

Virtual vs Real-World Interactions

People spend more and more time using their phones and computers



Virtual vs Real-World Interactions



The FRIDA project is an effort to encourage people to interact with real world more.

Painting robot is my favorite!



CoFRIDA: Collaborative FRIDA



Schaldenbrand, Parmar, McCann, Zhu, & Oh (ICRA'24 Best Paper Award, Human-Robot Interaction)



Catalyst to invite people to create arts



Burke Rehabilitation peer mentor Victor learning from mouth artist Veronica



Tanmay
Shankar



Peter
Schaldenbrand

We build compassionate, safety-aware, and creative Physical AI to work alongside humans, collaboratively creating flourishing experiences in the physical world.



Thank you for your attention!



Jean Oh



Jon Francis



Tanmay Shankar



Peter Schaldenbrand



Vihaan Misra



Lawrence Chen



Haokun Zhu



Chengyang Zhao



Ingrid Navarro



Uksang Yoo



Zhixuan Liu



Beverley-Claire
Okogwu



Hyun Parke



Alonso Cano Villarreal



Chan Seo



Ben Stoler



Pablo Ortega-Kral



Arthur F C Buckner



Gavin Zhu



Sunyu Wang



Eliot Xing



