

# KUI closing, what next

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# Studium

- B4B33RPZ - Rozpoznávání a strojové učení
  - více o statistickém rozpoznávání (poslední 2 přednášky)
  - více matematiky,
- B3B33VIR - Vidění robotu
  - více k robotice
  - hluboké sítě, Python, PyTorch, AI-Gym ...
- B0B33OPT - Optimalizace
  - minimalizace funkcí za omezení
- Magisterské studium, KyR, OI-Vision, OI-AI ...

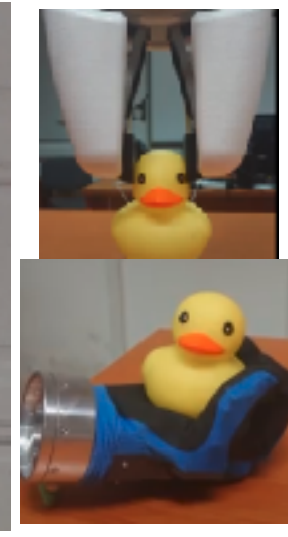
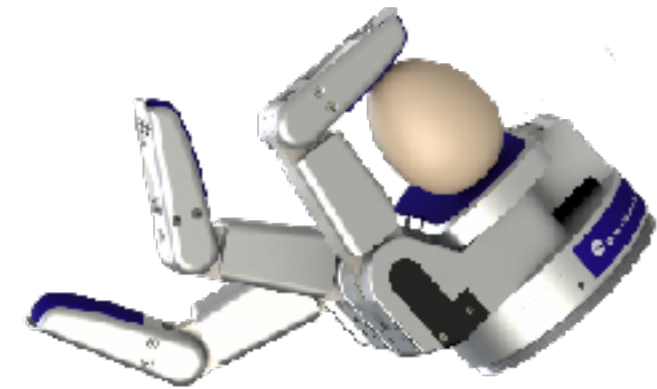
# Projekty, bakalářská práce, ...

- <http://www.fel.cvut.cz/en/education/semestral-projects.html>
- dívejte se kolem, navštěvujte semináře, přednášky
- <http://cyber.felk.cvut.cz/vras/>

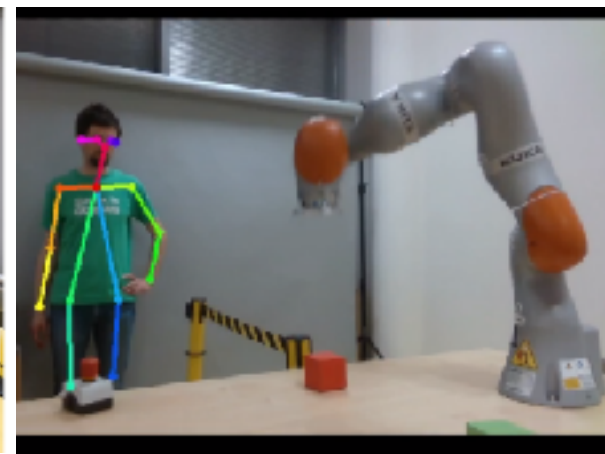
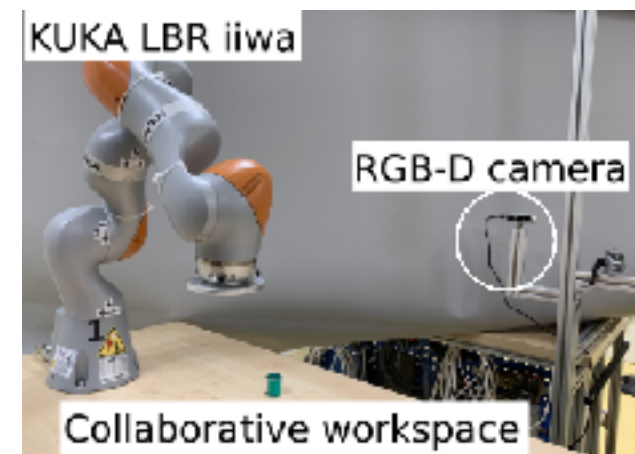


# Student projects @ Humanoids

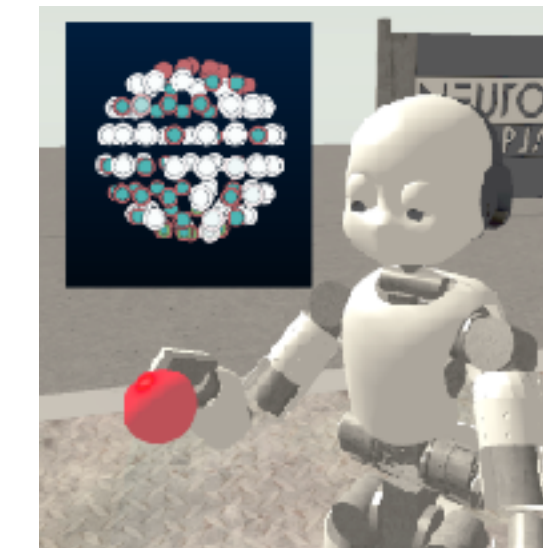
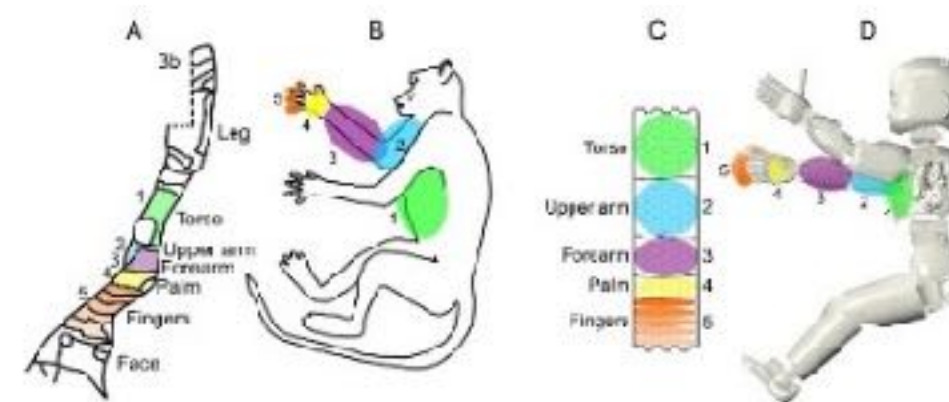
**exploring objects by vision and touch**



**collaborative robots and human-robot interaction**



**from babies and brains to robots**



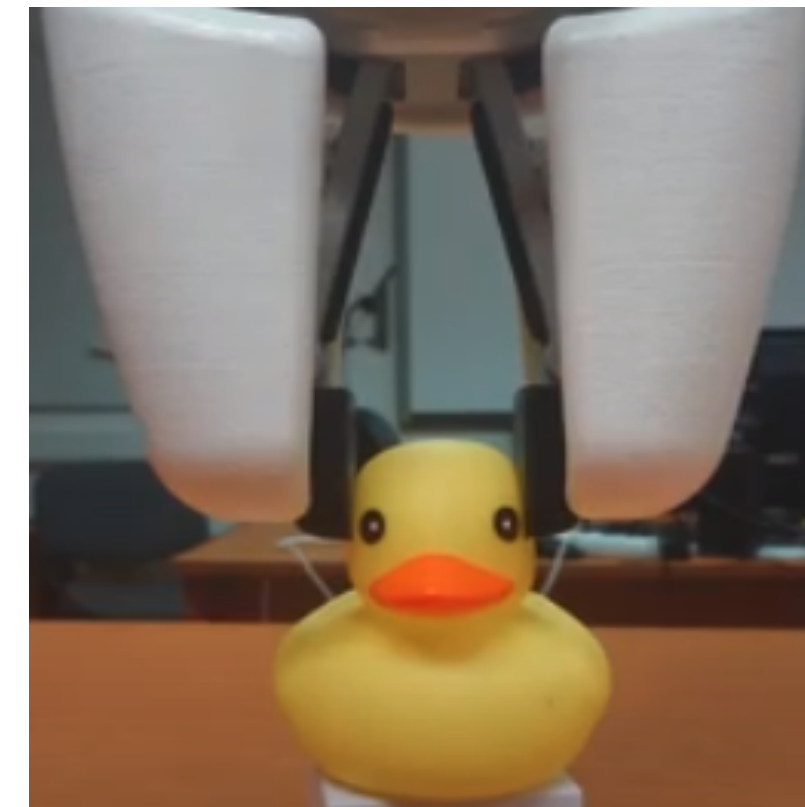
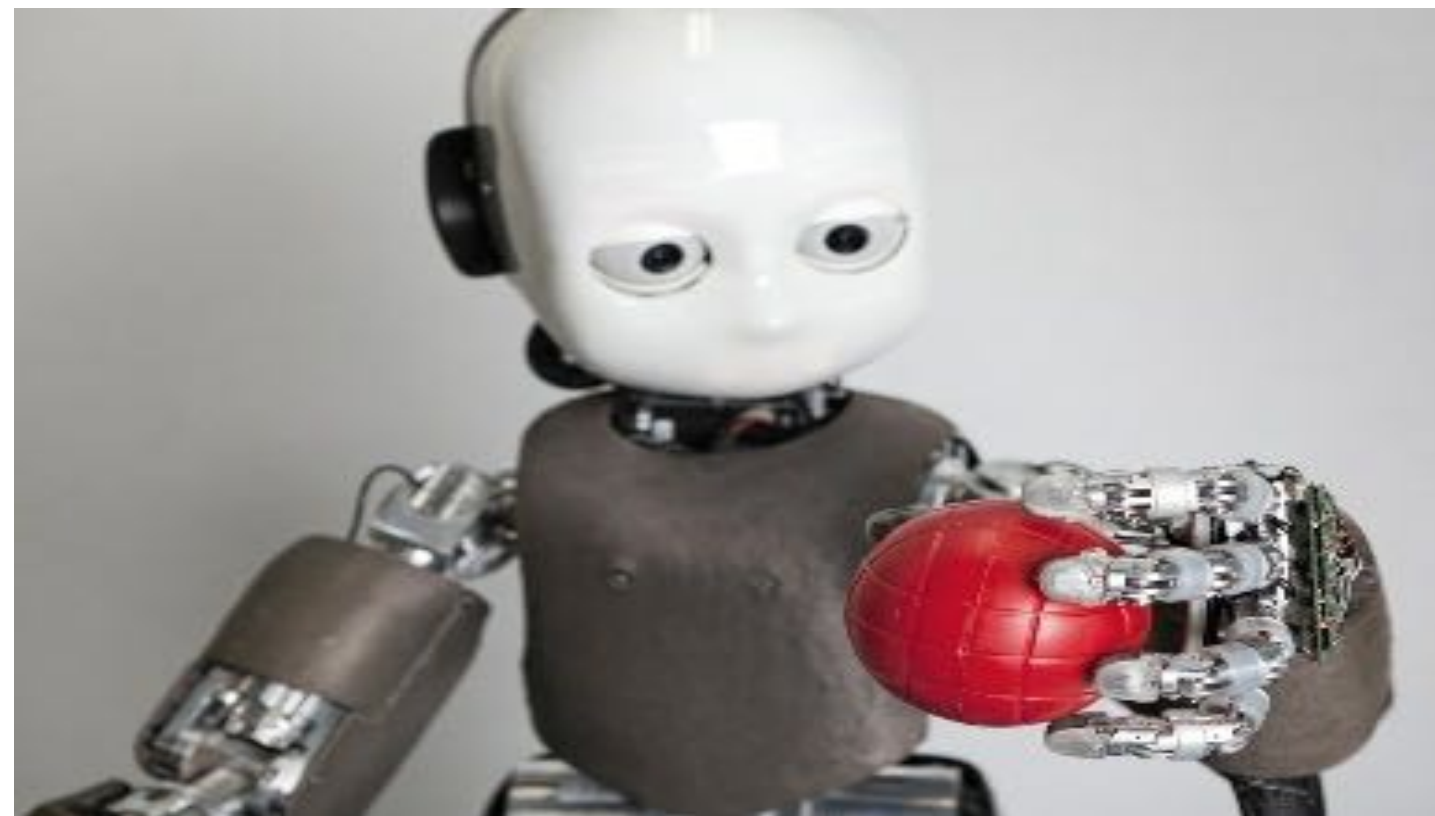
- Form: paid summer internship, bachelor project / thesis (possibly as follow-up on internship)
- Current overview: <https://sites.google.com/site/matejhof/student-projects/open-and-ongoing>



# KUI-related project example @ Humanoids

## Recognizing and exploring objects by vision and touch (soft objects)

- part of European project [IPALM](#)
- 3 robot manipulators (UR10e, KUKA LBR iiwa, Kinova Gen3) and 4 different robot grippers / hands (OnRobot RG6, Robotiq 2F-85, Barrett Hand, QB SoftHand)
- Possible task: Develop an object exploration strategy to verify the hypotheses/priors from vision about object pose, model, and properties. The actions may involve:
- manipulation (e.g., squeezing, pushing)
- visual exploration using moving camera (Intel Realsense D410 in the wrist of Kinova Gen3)





# CTU-CRAS-NORLAB

@DARPA Subterranean Challenge

URBAN CIRCUIT



<https://youtu.be/rTP64z52JFE>

<http://robotics.fel.cvut.cz/cras/darpa-subt/>

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- height-map representing a **rigid** terrain .....  $h_i$
- weighted pointcloud representing the robot .....  $\mathbf{p}_i, m_i$

one can estimate pose  $\alpha, \mathbf{t}$  as follows:



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$$\arg \min_{\alpha, \mathbf{t}} \sum_i m_i \cdot g \cdot [\mathbf{R}(\alpha) \cdot \mathbf{p}_i + \mathbf{t}]_z$$

$$h_i - [\mathbf{R}(\alpha) \cdot \mathbf{p}_i + \mathbf{t}]_z \leq 0 \quad \forall_i$$

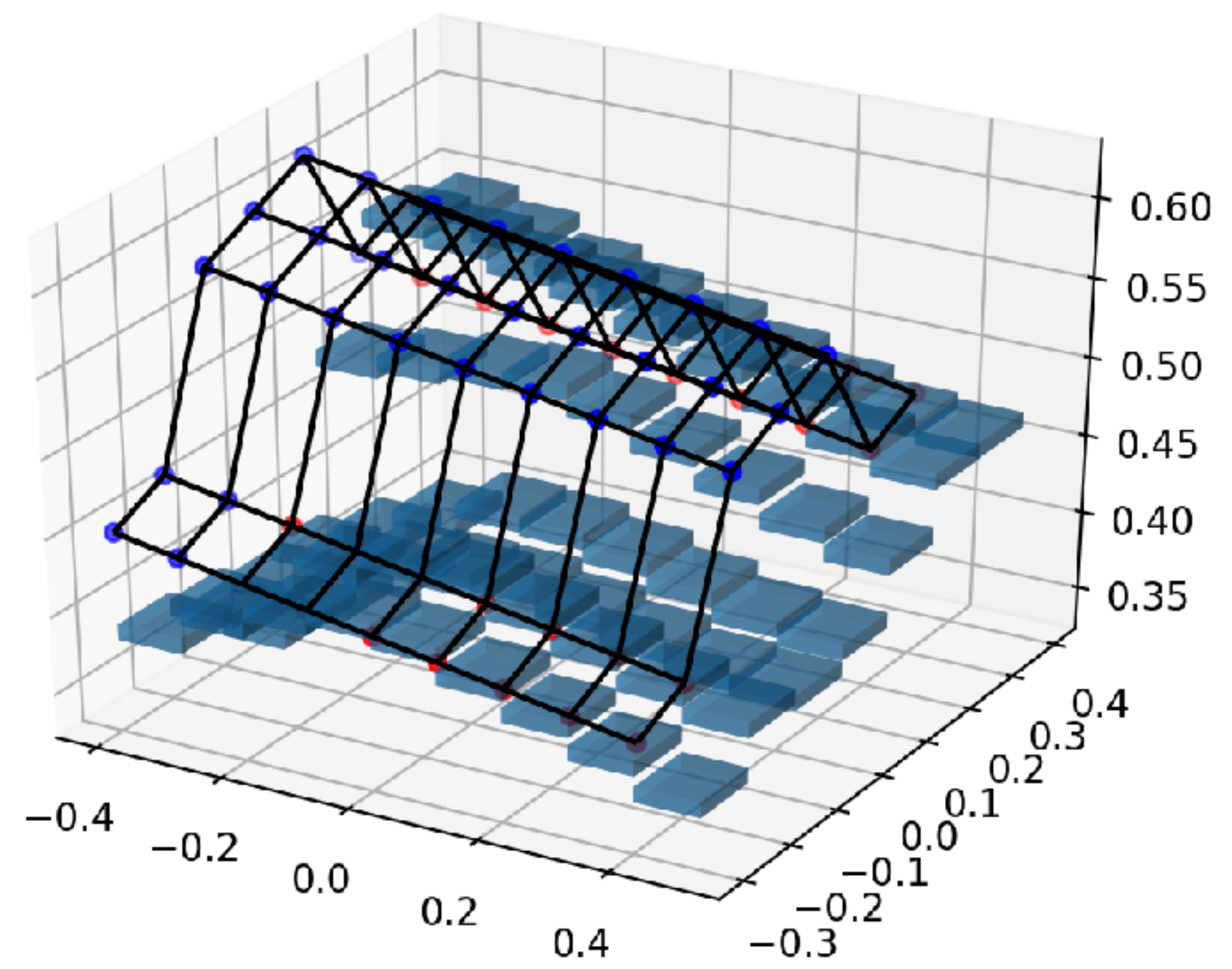
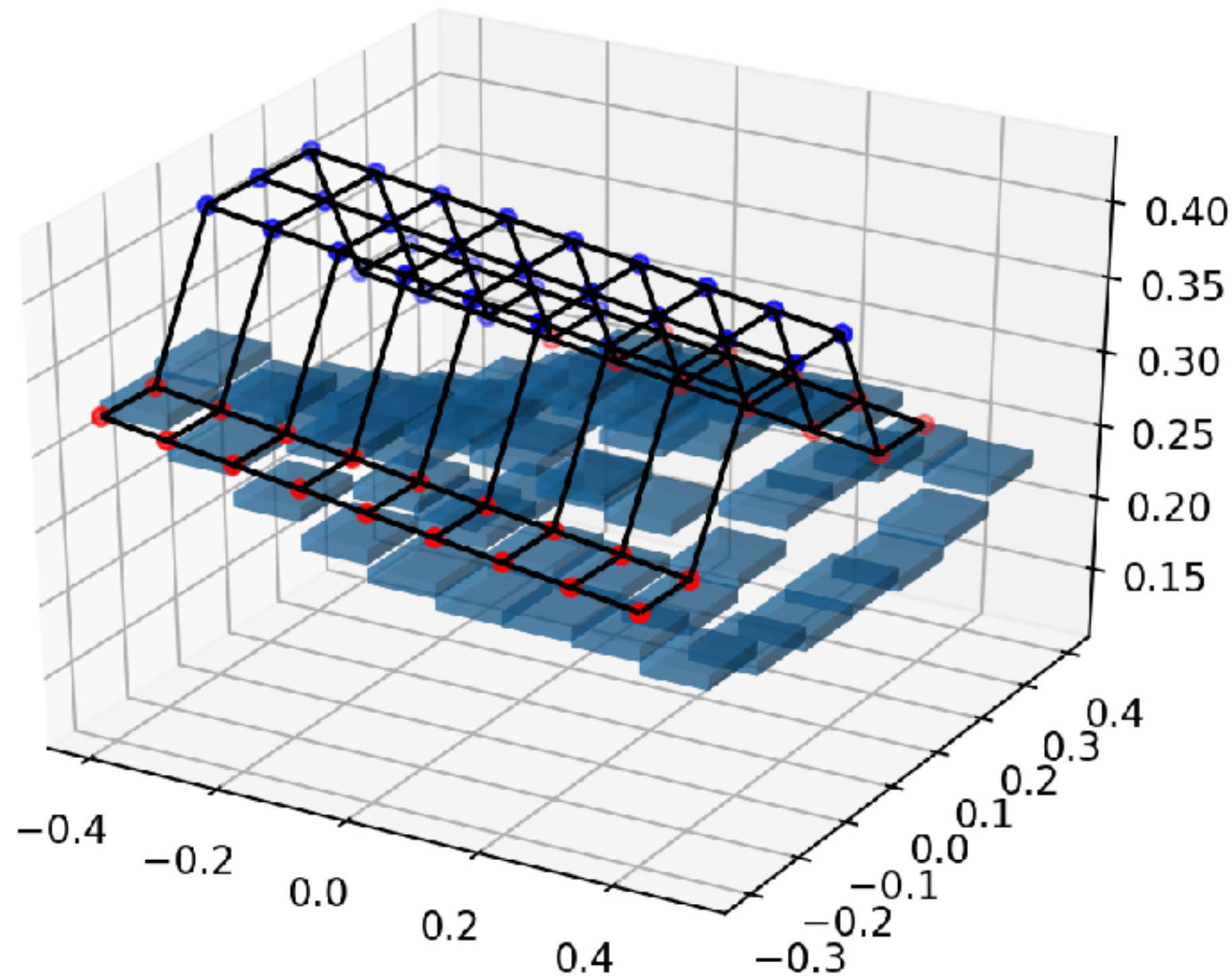
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# Zužitkování expertní trajektorie

