

Progress Report

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1 Specific Research Goals

- DLO Manipulation Dataset (ICRA - **Sept. 19th**) - on-going.
- VPQEKF (**—**): On pause. Asif may look into it.

2 To Do

- QEKF Paper (**On pause**):
 - Noise issue: noise cannot be modeled - DMD is a robust noise on high dimensional orthonormal time series and should be able to denoise QuEst solutions.
 - SfM: RQuEst cannot find solution - A potential solution is described briefly above.
- DLO Manipulation: (**ICRA - section out of date**)
 - Work on the paper everyday – up-coming
 - ICRA 2022 RL workshops: gym, stable-baseline3, and RL zoo – on-going
 - Setup digital twin reinforcement learning setup:
 - * Unity Robotics extension setup – on-going.
 - * Design dynamic DLO data collection system.
 - * Build work cell. – on-going
 - * Collect data and create a dataset.
 - * Define evaluation metrics.
 - * Create a high frequency RGBD dataset with UV-frames and open-loop input control actions as the ground truth.
 - Real-Time Preception – on hold
 - Learning DLO Dynamics and System Identification
 - * List feasible approached for learning DLO dynamics – done
 - * Model dynamics and deformity in a latent space

3 Progress

The following items are listed in the order of priority:

- DLO State Estimation (**ICRA - Sept. 15th**): I am working piDMD source code and trying to understand how I can use the **BCCB** configuration [1]. The provided examples are minimal and there are no instructions on how to use or even what it stands for. But fortunately I think I understand the underlying mathematics.
They acknowledge some of their solutions are unstable and provide an *alternative solution to the upper-triangular piDMD problem*. They use *economy RQ decomposition of X* to write (84) and since *the first two terms of (84) are independent of \mathbf{A} and, by multiplicity of the Frobenius norm, have a non-negative sum*. On this basis, the upper-triangular Procrustes is phrased (85) and borrowing a multi-row-wise optimization computational technique from *Block Discrete Fourier Transform*, they write (88) as a direct solution for \mathbf{A} , given provided ***data is rank deficient***. Most often in real-world experiments, data collected is rank deficient due to noise and measurement imperfections. Moreover, they provide (89) as means to compute \mathbf{R} recursively backwards in order increase computational efficacy.
- Maicol (REU): He did well. DT is the future the industry has been dreaming of.
- DoD SMART (**Dec 1st**): I started the application.
- XEst (**RAL —**): No update.
- PyTorch Tutorials: Transfer learning.

References

- [1] P. J. Baddoo, B. Herrmann, B. J. McKeon, J. N. Kutz, and S. L. Brunton, “Physics-informed dynamic mode decomposition (pidmd),” *arXiv preprint arXiv:2112.04307*, 2021.