IFOR: Iterative Flow Minimization for Robotic Object Rearrangement
Rearrangement

Current Scene

Target Scene

- **Input**: RGBD of the target and current
Rearrangement

- **Input**: RGBD of the target and current

- **Objective**: Rearrange to the target configuration
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• **Objective:** Rearrange to the target configuration
Rearrangement

Setting Dinning Table  Cleaning House  Organising Cabinets

Canonical task for Embodied AI [1]

How to Rearrange?

Need to recognize the change in pose of objects.
Challenges

- Unseen objects
- Traditional pose estimator won’t work 😞
- Object-invariant intermediate representation like flow?
- Solve rigid-body transform from flow (+ segmentation) 😊
Challenges

• Flow values large

• Traditional flow estimators won’t work 😞

• A **suitable** neural flow estimator with trained **correct** data?

• Works very well! Transfers from sim-to-real in zero shot 😊
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Off-the-shelf Unseen Object Segmentation [1]

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IFOR: Optical Flow

Synthetic Dataset For Rearrangement — NVISII Renderer

50K Samples for Training
IFOR: Optical Flow

[1] Teed, Zach and Deng, Jia “RAFT: Recurrent All-Pairs Field Transforms for Optical Flow”
IFOR: Optical Flow

Key Observation:

Compares each pixel to all other pixels => In theory, learn large flows

[1] Teed, Zach and Deng, Jia “RAFT: Recurrent All-Pairs Field Transforms for Optical Flow”
**IFOR**

Iterative Flow Minimization for Robotic Object Rearrangement

Solve for rigid-body transformation: **multi-view geometry + RANSAC**
Iterative Flow Minimization for Robotic Object Rearrangement

Current Scene -> Segmentation -> Predicted Optical Flow

Current Depth -> Flow Minimization

Goal Depth

Planning and Execution

Update current scene and repeat if necessary
Example

Target Image

IFOR (ours) 8X

NeRP 8X
In blind user study, IFOR (ours) was consistently rated to perform good!

>92% of time users preferred IFOR (ours) over prior-art
Project Page: https://imankgoyal.github.io/ifor.html

Poster: 23 June 2022, 2:30 - 5:30 PM, 144B