



Massachusetts  
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# Dynamic Reconstruction of Hand-Object Interaction with Distributed Force-aware Contact Representation

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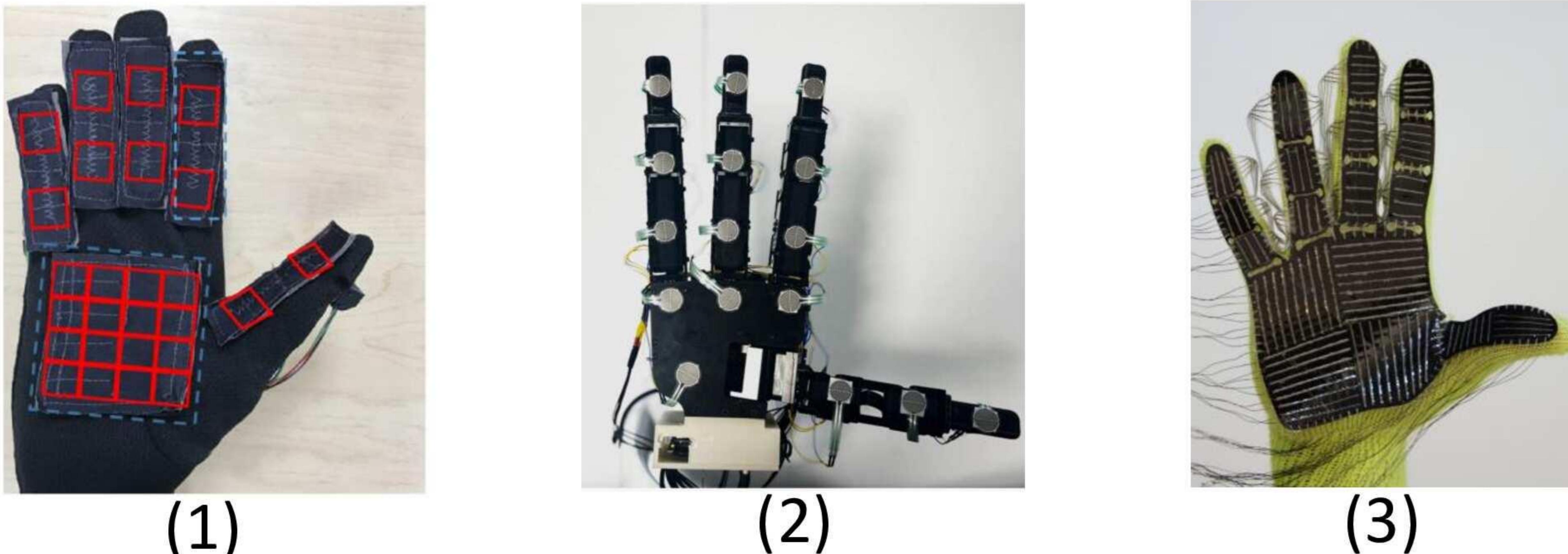
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# Introduction

(a)



(b)



Different types of distributed tactile sensing

## Force-aware Contact Representation: DF-Field

- Hand-object reconstruction refinements with fore-aware optimization from distributed tactile information

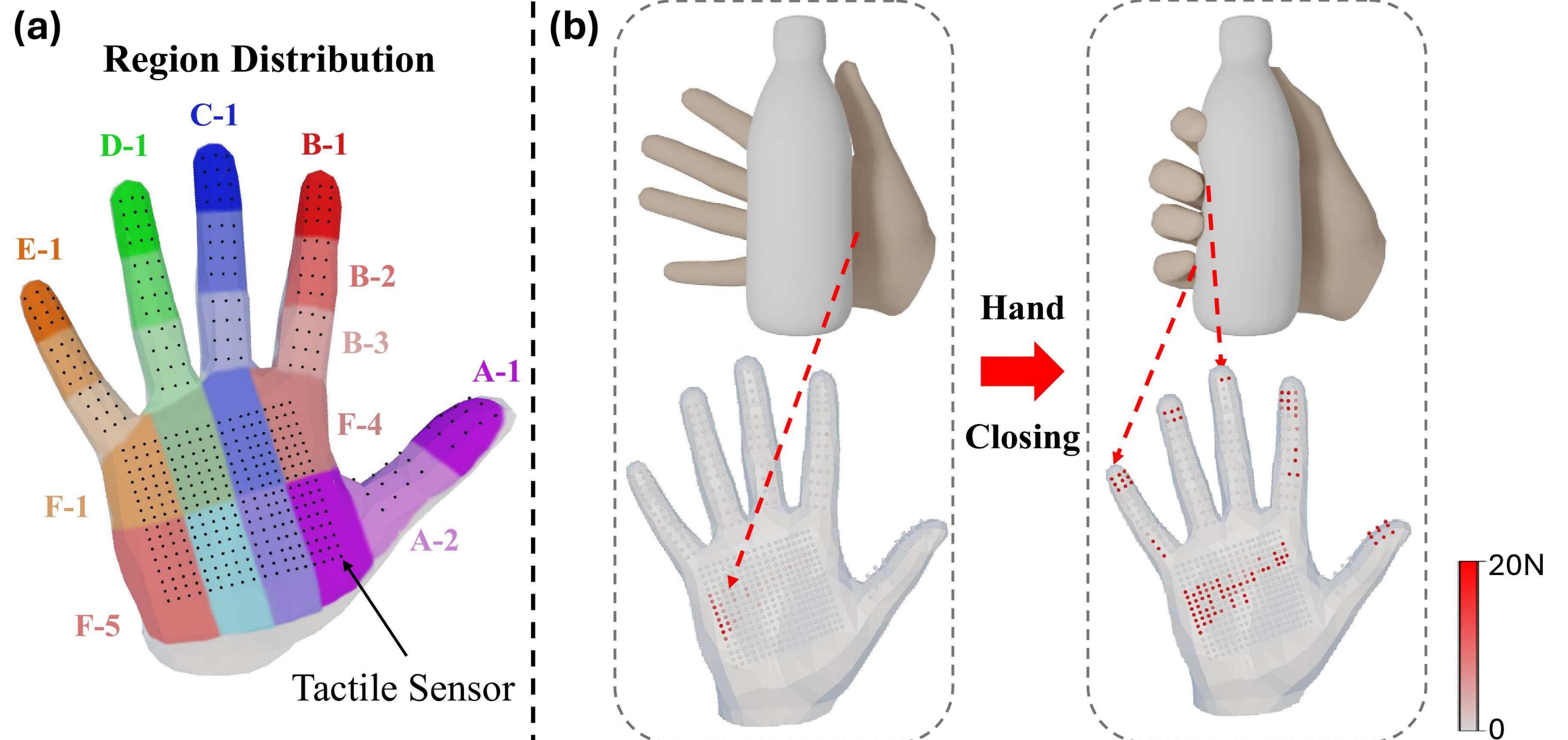
## Visual-tactile learning Framework: ViTaM-D

- Dynamic 4D reconstruction of hand-object interactions with 3D visual perceptron and distributed tactile sensing (tactile gloves in (b))

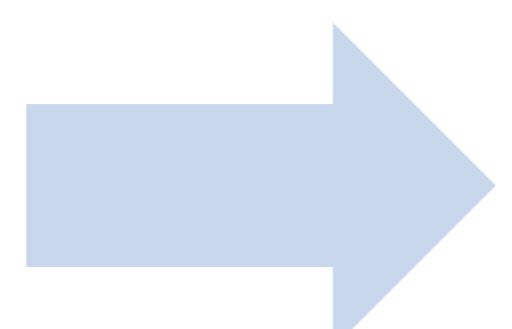
## Hand-Object-Tactile Dataset: HOT Dataset

- 600 RGB-D manipulation sequences on 30 deformable objects from 5 categories with penetration-free hand-object poses and accurate tactile information

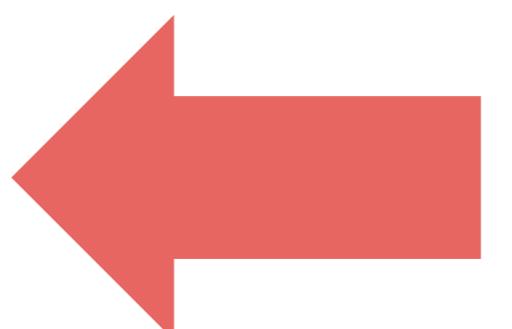
# Force-aware Contact Representation: DF-Field



Relative Potential Energy



Overall Energy

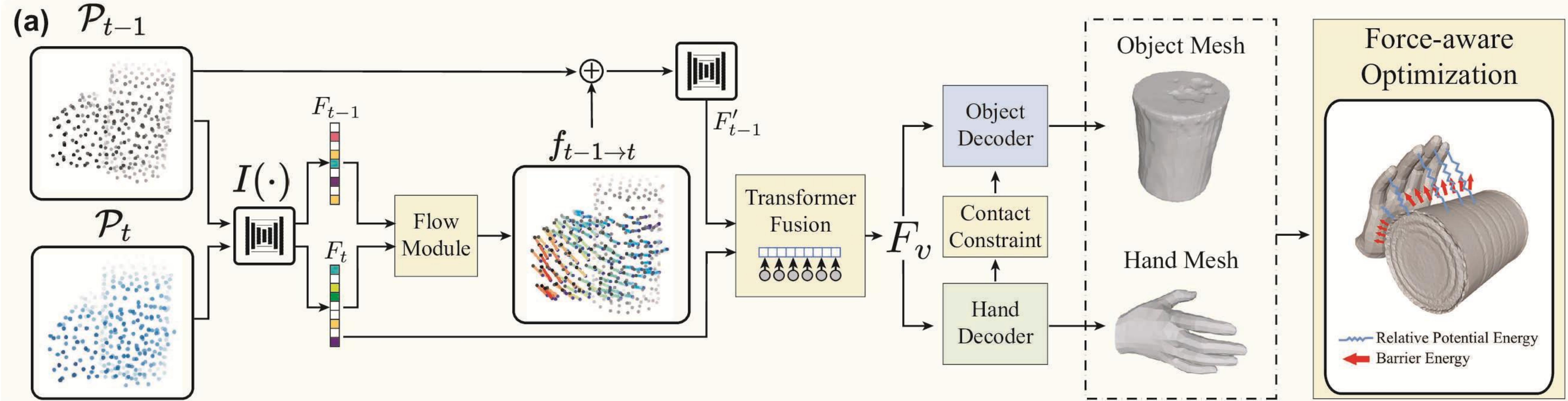


Barrier Energy

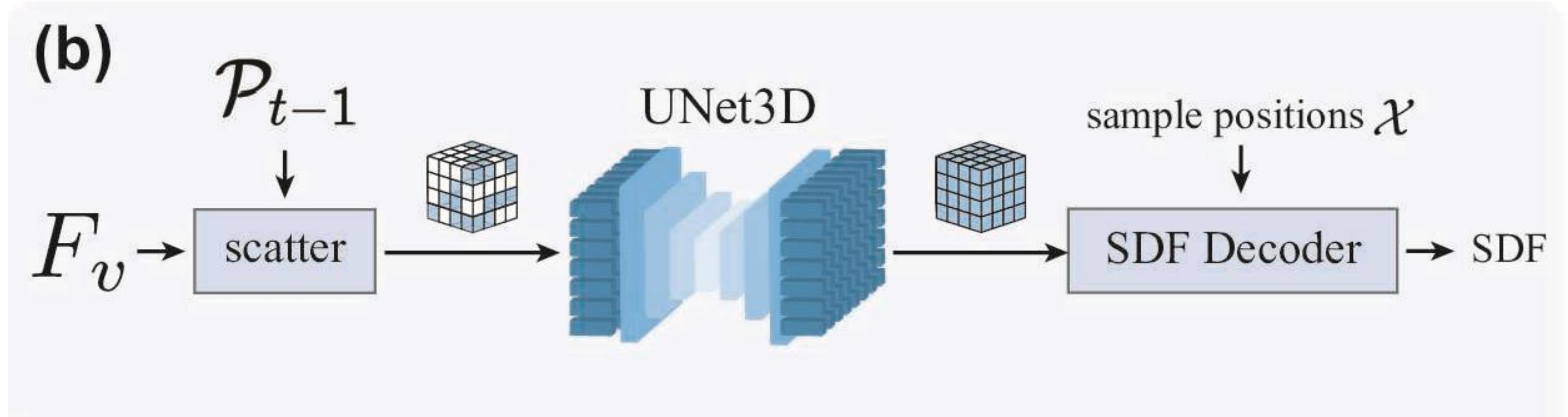
$$E_{ij} = \kappa l_{ij}^2 \quad \kappa \sim \frac{\overline{\mathcal{M}^j}}{l_{ij}}.$$

$$E = \sum_i \sum_j (E_{ij} + B_{ij})$$

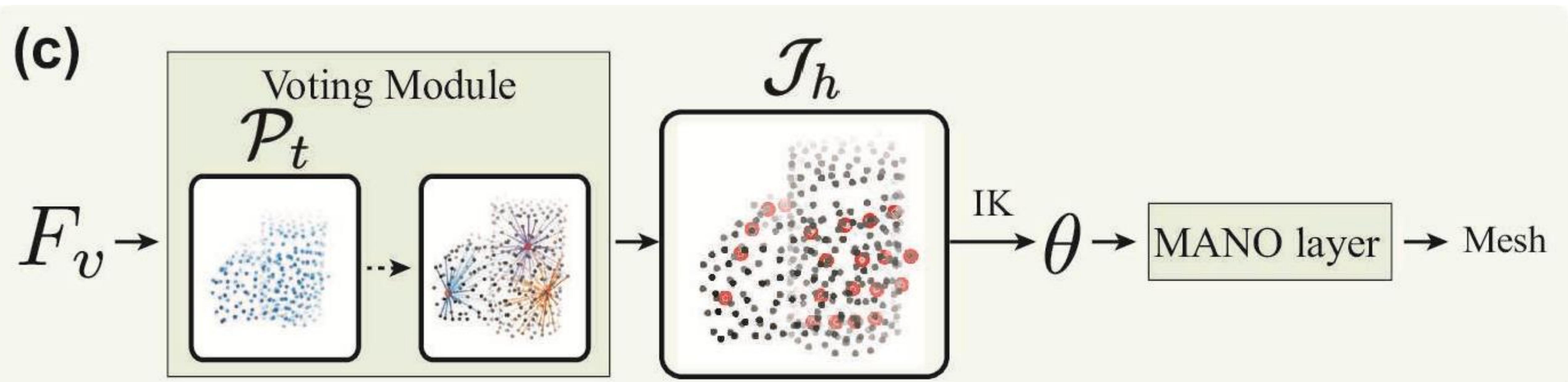
$$B_{ij} = -e^{-\kappa} (l_{ij} - \hat{l})^2 \log\left(\frac{l_{ij}}{\hat{l}}\right)$$



## Object Encoder



## Hand Encoder



# Experimental Results

