Roto-translated Local Coordinate Frames
For Interacting Dynamical Systems

Motivation
- Roto-translation equivariance
  - Colliding particles
  - N-body systems
  - Molecules
  - Motion capture
  - Traffic scenes

Dynamics do not change under rotations and translations.

Most works do not have this property and address it approximately using data augmentation techniques.

Motivation - Ego-centric perspective
Objects often operate in ego-centric and asymmetric views of the world.

However, graphs are often embedded in arbitrary global coordinate frames.

Roto-translated Local Coordinate Frames
We propose local coordinate frames for all objects in an interacting dynamical system. Each local coordinate frame is translated to match the target object's position and rotated to match its orientation/velocity.

Anisotropic Continuous Filtering
Directionality in local coordinate frames allows for anisotropic continuous filters.

Neural Relational Inference Backbone

In principle, our method is agnostic to the choice of backbone architecture and can be integrated to any graph network that operates on spatially positioned nodes evolving through time.

Results
Experiments on 2D/3D settings show the effectiveness of our method.

References

https://github.com/mkofinas/loc