End-to-End Learning-Based Non-Verbal Behavior Generation of Social Robots

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Introduction

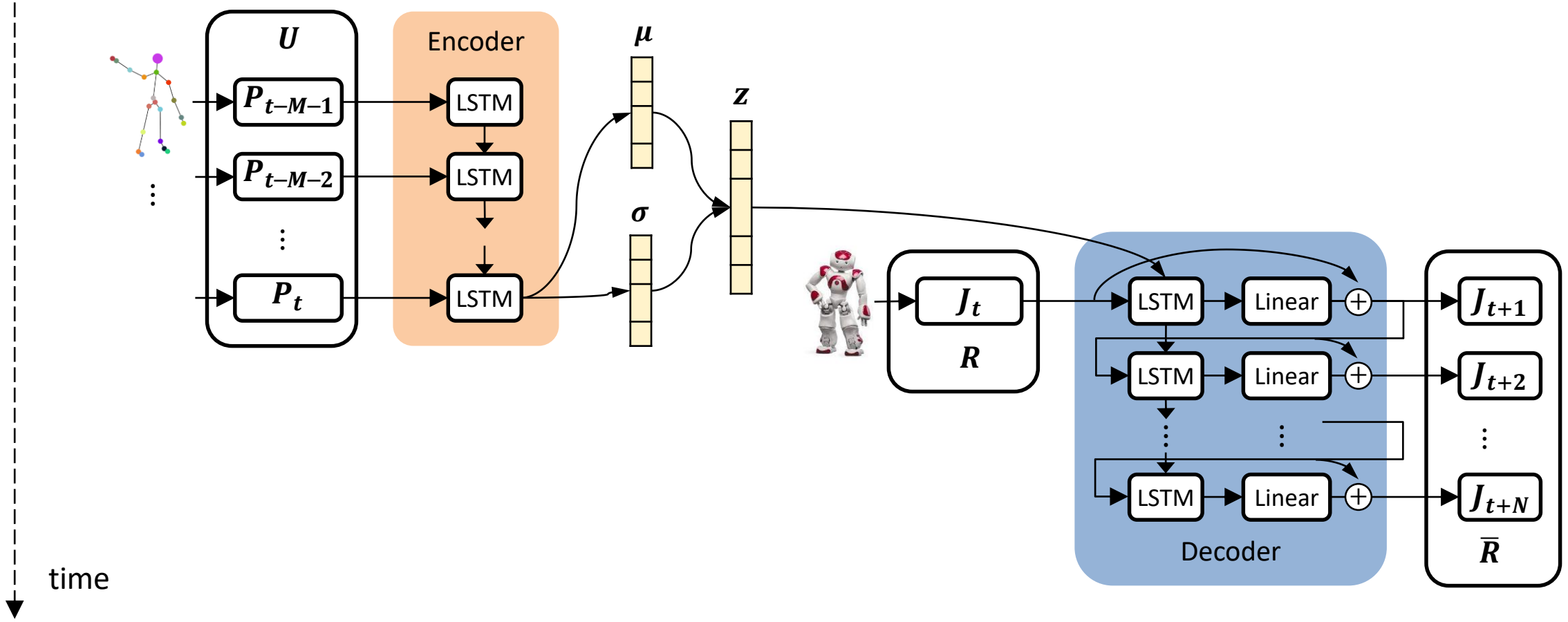
- **In order for users to feel familiar with social robots**
  - Social robots should be able to generate non-verbal robot behaviors, such as *handshakes*

- **Traditional approaches : reproducing pre-coded motions**
  - Allow users to easily predict the robot's reaction
  - Give the impression that the robot is a machine and not a real agent.

- **Our method : end-to-end learning-based behavior generation method**
  - Enable social robots to learn multiple human-like behaviors from human-human interactions

Proposed Method

- **Seq2Seq-based architecture** : consisting of encoder and decoder LSTMs



Experimental Results

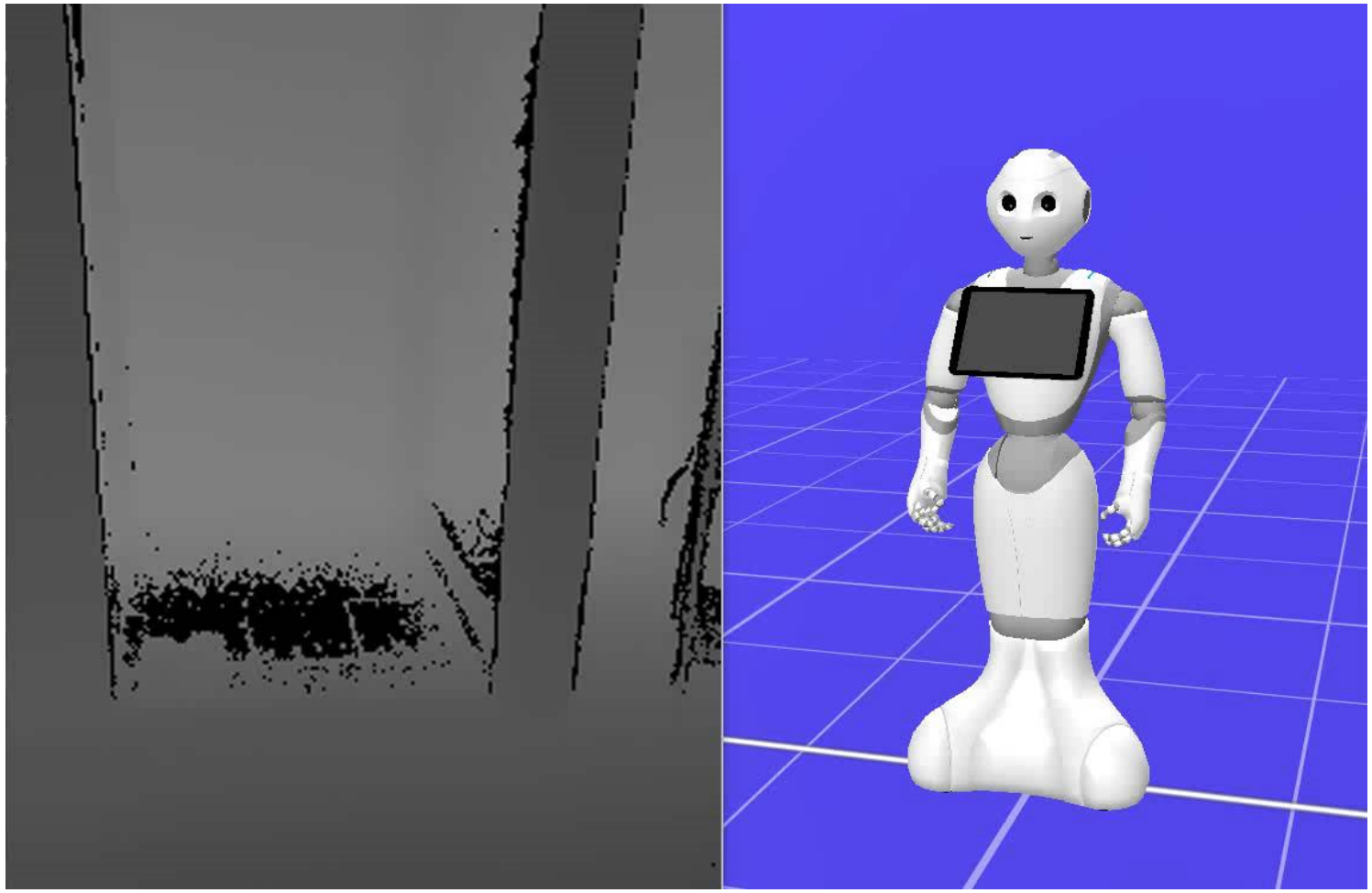
- **Preparation : Training Model**
  - AIR-Act2Act dataset (https://github.com/ai4r/AIR-Act2Act)

Scenario	Person 1 (=User)	Person 2 (=Robot)
1	enters into the service area through the door	bows to him
2	walks around without a purpose	stares at him
3	stands still without a purpose	stares at him
4	lifts his arm to shake hands	shakes hands with him
5	covers his face and cries	stretches his hands to hug him
6	threatens to hit	blocks the face with arms
7	turns back and walks to the door	bows to him.

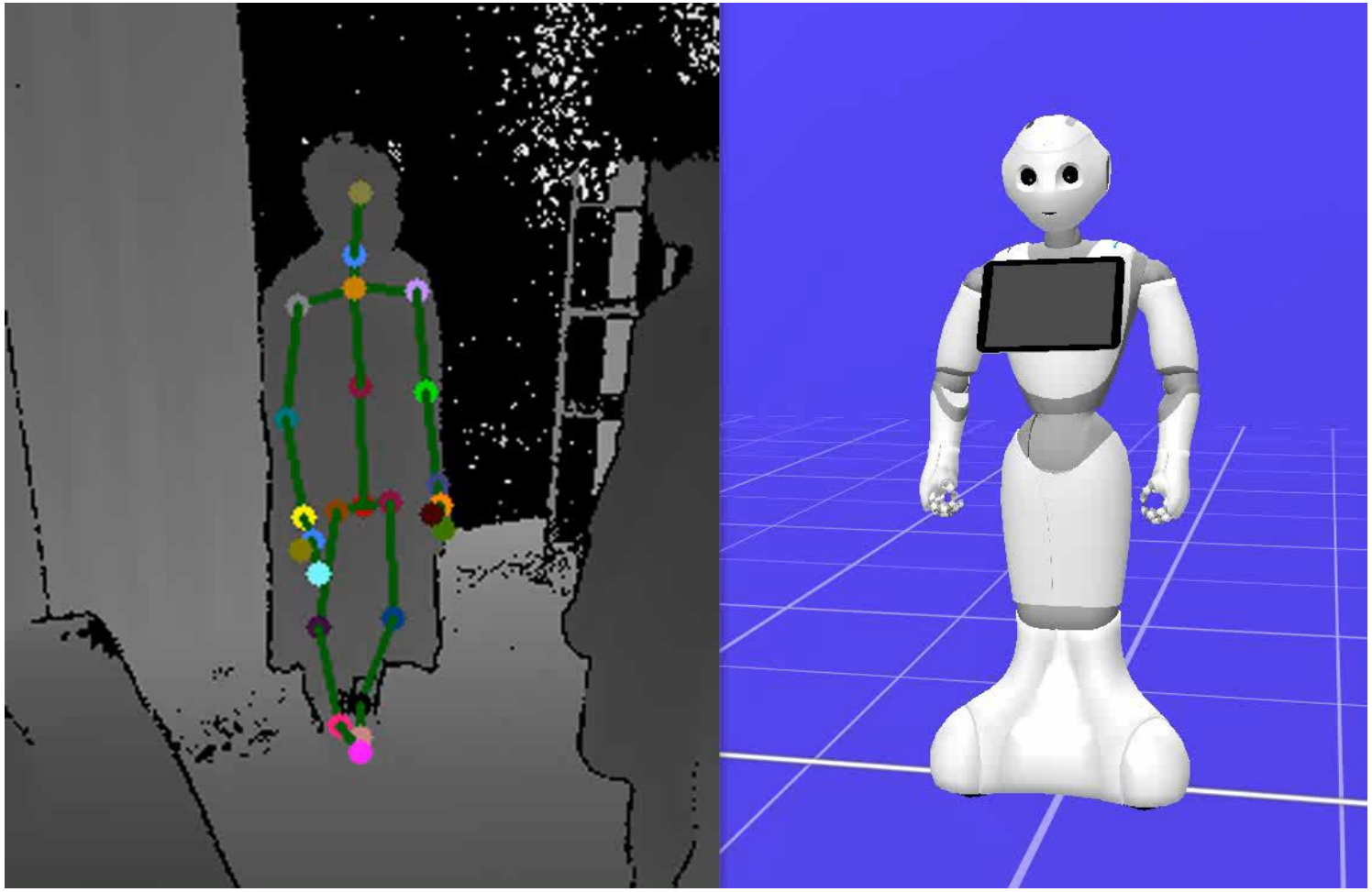
  - Numbers of Extracted Training and Test data

	Training	Test	Total
Interaction samples	1,575	175	1,750
Extracted data	116,462	12,738	129,200

- **Experiment 1** : Robot behaviors generated in 7 interaction scenarios



- **Experiment 2 : Robot behaviors generated when a user lifted his right arm to different positions**



Conclusions

- **End-to-end learning method for generating non-verbal behaviors of social robots**
  - Inputs: the user's previous poses and the current robot pose
  - Outputs: the robot's next poses

- **Two experiments were carried out using a humanoid robot, *Pepper*, in a simulated environment**
- **Experimental results showed that the robot can**
  1) Successfully generate multiple social behaviors corresponding to the human behavior
  2) Adjust its behavior according to the user posture

Thank You for Your Attention