창의IT설계 II

Learning Robot Activities for mimicking human motion remotely from third-Person Videos
~ Toward Robot Avatar ~

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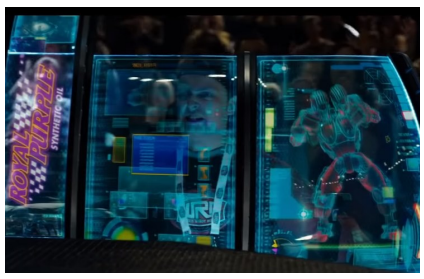
#Deep_Learning #Robotics #3D_vision

Motivation

Robot intuitively controlled by visual input

VS

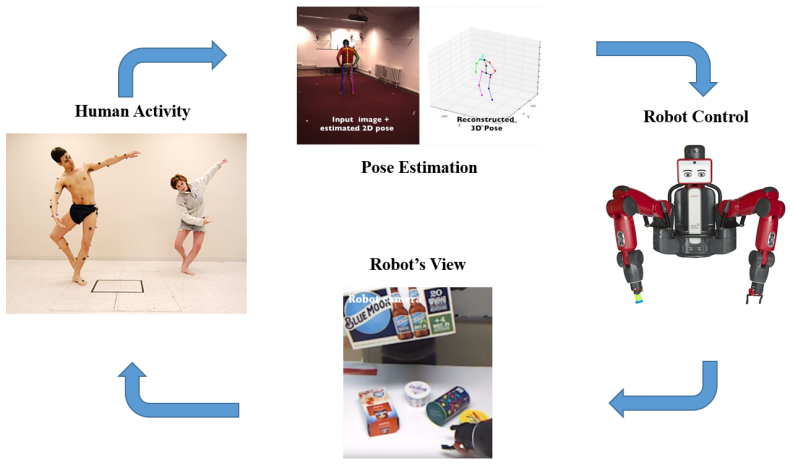


Robot controlled by complicated input interface

- [Real Steel], Shawn Levy, 2011
- Human can follow one's motion by watching it.
- (Goal) Make robot to follow person's motion only with camera!
- (Value) Reduce cost of robot control system with tradeoff of accuracy. Make robot control easy and intuitive.

System

- Robot Control System
  - Control is implemented with 2D Pose Estimation.
  - Calibration process is needed to get robot arm angle state from 2D Pose.



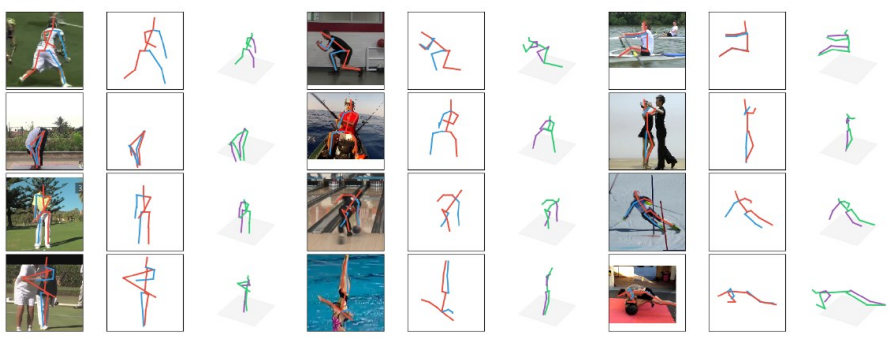
Robot Control Process

Background

- Existing System
  - Toyota's T-HR3
  - Needs complicated, expensive, heavy sensor system
  - Uses torque sensors
  - Accurate

Toyota's T-HR3

- Human Pose Estimation
  - 2D Pose Estimation is pretty much solved problem.
  - 3D Pose Estimation is still struggling for performance.



Human 2D & 3D Pose Estimation

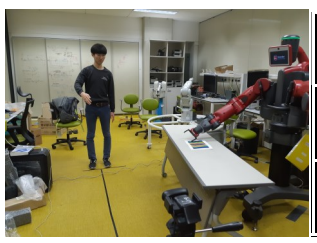
From [A simple yet effective baseline for 3d human pose estimation] by J. Martinez et al.(2017)

- Baxter Research Robot
  - Two 7-DOF arms
  - First-person view camera
  - Provide high level API for position control

Baxter Research Robot

Evaluation

- Quantitative evaluation
  - Position Error of End Effector



Statistic \ Axis	X axis	Y axis	Z axis
Mean of Error	7.00	5.60	6.00
Standard deviation of Error	4.42	3.53	4.02

- Qualitative evaluation
  - Following various poses

  - Lifting up objects

Conclusion & Future Works

- Built a low-cost and intuitive humanoid robot control system with a camera, in which a tradeoff is between accuracy and complexity of sensor system.
- Control performance can be improved by using decent 3D Pose Estimation and sophisticated Inverse Kinematics or Reinforcement Learning.