

European Robotics Forum 2017

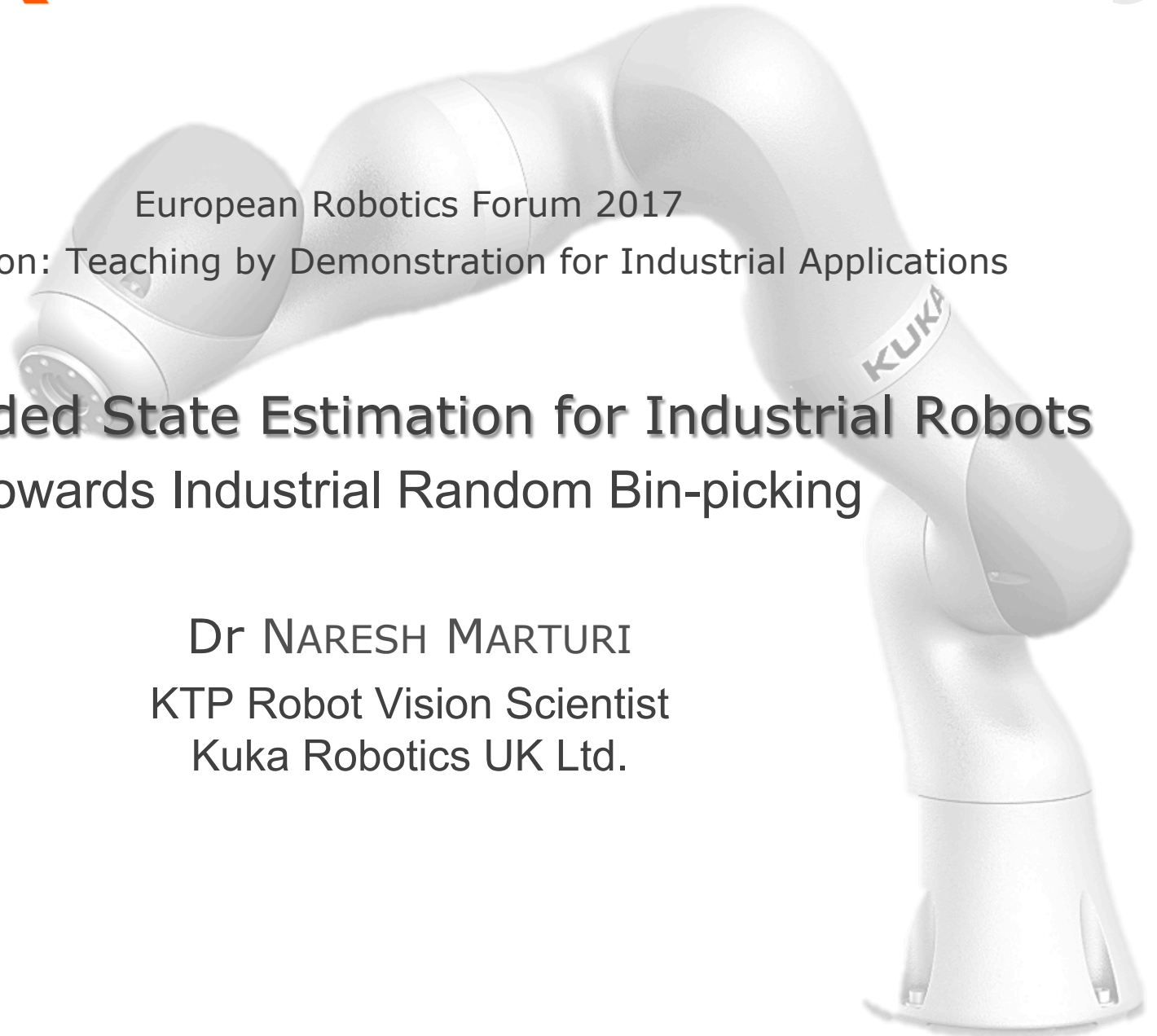
Workshop on: Teaching by Demonstration for Industrial Applications

Vision-guided State Estimation for Industrial Robots Towards Industrial Random Bin-picking

Dr NARESH MARTURI

KTP Robot Vision Scientist

Kuka Robotics UK Ltd.



Industrial Bin-picking

Random Industrial Bin-picking

- Locating + gripping objects in the correct orientation from a bin in which they are randomly positioned and unsorted
- An important problem confronting many automated assembly processes
- Major application in automotive industry



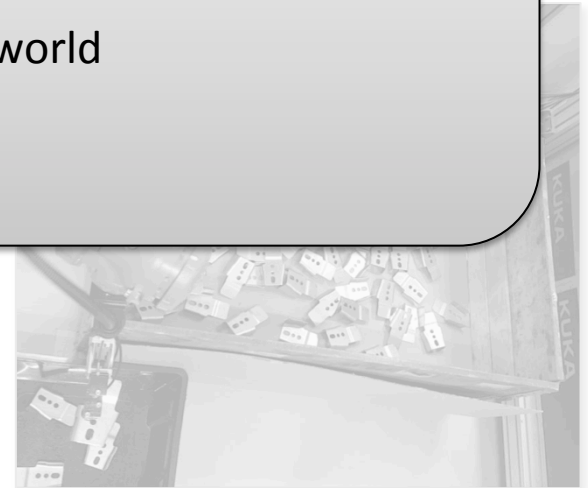
Industrial Bin-picking

Random Industrial Bin-picking

- Locating + gripping objects in the correct orientation from a bin in which they are randomly positioned and unsorted
- An industrial robot arm
- Major challenges

How the task can be accomplished..

- Acquire image (if possible 3D) of the objects and the bin
- Segment unwanted regions
- Detect and calculate object location in real world
- Generate a trajectory for the robot
- Grasp and transfer the object



Industrial Bin-picking – Challenges

A lot of challenges to tackle:

- Surface reflections
- Noise/waste added by environment (dark, dirt, grease etc.)
- Variable appearance : arbitrarily oriented objects
- Extreme background clutter
- Parts are in a random and unstructured environment
- Vision algorithms need to be precise
- System has to be well calibrated
- High computation time : (half a million points in one single scan to process!!!)
- Effective and flexible grippers to be able to handle parts

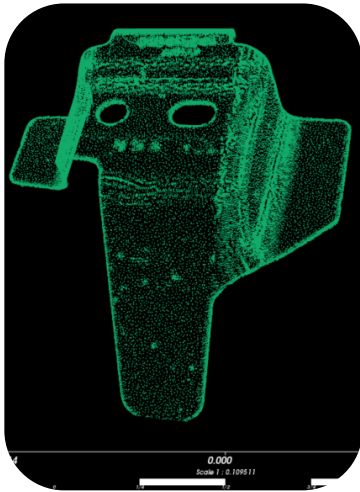
... and many more



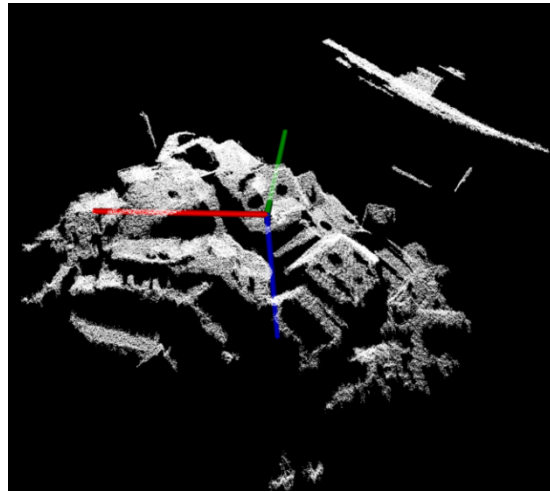
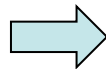
Courtesy: WordPress

Our Approach of Bin-picking

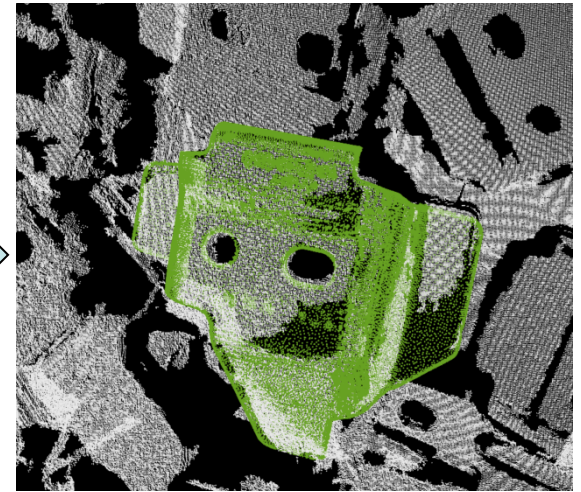
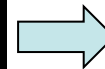
- Making use of the advanced computer systems (GPU)
- Selection of suitable sensory system: 3D Vision – Ensenso
 - Tweak the projection to compensate reflections (Eye-on-hand)
 - Other option: Laser scanner mounted inside workspace
- CAD model-matching to point clouds – Using deep neural nets



Reference



Source Cloud



Result

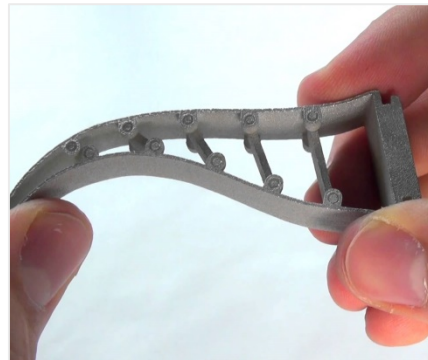
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- Robot is then commanded to pre-grasp location
 - Path planner – random trees
- Grasping..?
 - Still an issue



Associated Problems

- Grasping not successful due to part complexity
- Tried grippers: suction, 2 finger, fin-finger, coffee bean
- Major problem arises due to surrounded clutter and limited freedom
 - Available grasp planners works well for single objects



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Possible Directions

- Teach the possible grasping locations considering clutter
- Evaluate and generate multiple hypothesis
 - Chose the best one
- Any suggestions are welcome

