An embedded Intelligent 3D object recognition system for random bin picking.

Keywords:
• Stereo vision, Structure light phase shift, Polarized imaging system, Random bin picking, Object recognition, Object registration, 6D pose estimation, Machine learning, Backpropagation learning

Problems addressed
• Traditional automation involves robots that faithfully carry out specific actions repeatedly based on programs meticulously crafted by highly skilled engineers
• These robots are inflexible and ill-fitted for production of goods with short product lifecycle
• In high-productivity manufacturing line, parts detection and posture estimation must be performed in real-time

ASTRI’s vision guided random bin picking system integrates AI based “eye” onto the robotic arm. Picking path is automatically calculated after object is located via Self-Learning 3D object recognition to reduce the engineering efforts.

Innovations
Eye (Adaptive Embedded 3D Vision System) + Brain (Self-Learning 3D Object Recognition):
• Data Generation Engine: Generate artificial AI training data through 3D engine. No manual labelling is required

• Deep Learning: Extract object features by AI to train an appropriate model without the need of manual parameter tuning for new object

• Adaptive Optical Design: Adopts coded phase shift light pattern and dual-polarized optical design, the system is automatically adapted to different production line environment & multiple measured objects

• GPU Accelerated Point Cloud Processing: Apply GPU accelerated algorithm on object recognition to ensure speed (< 0.5 s 3D recognition time) and accuracy (0.1 mm @ 0.5m)

Key impact
• Enhancement of the flexibility of manufacturing line by enabling efficient reconfiguration for multiple products
• Increasing the throughput of the manufacturing line in low-cost
• Expediting the upgrading of local industries with flexible cutting-edge 3D robot cognition to perform complex tasks in advanced manufacturing

Project completed
• August 2020

Applications
• Random Bin Picking
• Defect Inspection
• Assembly
• Autonomous robot navigation

Patent(s)
• US Patent No. 11,287,626; CN App. No. 201980000804.2
• US Patent No. 11,023,770; CN App. No. 201980002023.7 and HK App. No. 62020022213.6

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