**Full Pose Estimation of Household Objects**

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**Goals**
- Recognition and full pose estimation of all relevant objects to perform household tasks
- Pose accuracy to enable object manipulation by a robot arm
- Robust performance in unstructured environments
- Fully automatic system

**3D Object Modeling**
- Each relevant object is modeled from a few training images
- Structure from Motion algorithm creates sparse 3D models from natural features

**Pose Estimation**
- New image is matched against every object model in database
- Automatic pose initialization for non-linear optimization by estimating scale, rotation and translation of model
- Non-linear optimization on matched features to recover full pose

**Robustness to Cluttered Environments**
- Clustering of image features and randomized algorithm allows for efficient recognition of multiple instances of multiple objects in cluttered environments

**Viewpoint Invariance**
- Invariance to viewpoint is essential in overcoming barriers of object recognition in an uncontrolled environment
- Image features are extracted from affine transformed training images and incorporated into sparse 3D object models to simulate novel viewpoints

**Applications**
- System output is accurate enough for object manipulation
- Enhance human perception for tasks in daily life

**Grasping using visual input**

**Wearable sensing**

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