

# Stanford

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## Silvio Savarese

Associate Professor of Computer Science

### CONTACT INFORMATION

- **Administrator**

Tin Tin Wisniewski - Faculty Administrator

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### Bio

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#### BIO

Silvio Savarese is an Associate Professor of Computer Science at Stanford University and the inaugural Mindtree Faculty Scholar. He earned his Ph.D. in Electrical Engineering from the California Institute of Technology in 2005 and was a Beckman Institute Fellow at the University of Illinois at Urbana-Champaign from 2005–2008. He joined Stanford in 2013 after being Assistant and then Associate Professor of Electrical and Computer Engineering at the University of Michigan, Ann Arbor, from 2008 to 2013. His research interests include computer vision, robotic perception and machine learning. He is recipient of several awards including a Best Student Paper Award at CVPR 2016, the James R. Croes Medal in 2013, a TRW Automotive Endowed Research Award in 2012, an NSF Career Award in 2011 and Google Research Award in 2010. In 2002 he was awarded the Walker von Brimer Award for outstanding research initiative.

#### ACADEMIC APPOINTMENTS

- Associate Professor, Computer Science
- Member, Wu Tsai Neurosciences Institute

#### ADMINISTRATIVE APPOINTMENTS

- Mindtree Faculty Scholar, Mindtree, (2018- present)

#### PROGRAM AFFILIATIONS

- Stanford SystemX Alliance

#### LINKS

- <http://cvgl.stanford.edu/silvio/>: <http://cvgl.stanford.edu/silvio/>

### Teaching

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#### COURSES

##### 2017-18

- Computer Vision: From 3D Reconstruction to Recognition: CS 231A (Win)
- Representation Learning in Computer Vision: CS 331B (Aut)

#### 2016-17

- Computer Vision: From 3D Reconstruction to Recognition: CS 231A (Spr)
- Representation Learning in Computer Vision: CS 331B (Aut)

#### 2015-16

- Computer Vision: From 3D Reconstruction to Recognition: CS 231A (Spr)

### STANFORD ADVISEES

#### Doctoral Dissertation Reader (AC)

Li Yi

#### Postdoctoral Faculty Sponsor

Roberto Martín Martín, Claudia Perez D Arpino, Amir Zamir

#### Doctoral Dissertation Co-Advisor (AC)

John Emmons, Suraj Nair

#### Master's Program Advisor

Xiuye Gu, Benjamin Penchas, William Shen

#### Doctoral (Program)

JunYoung Gwak

## Publications

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### PUBLICATIONS

- **Watch-n-Patch: Unsupervised Learning of Actions and Relations** *IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE*  
Wu, C., Zhang, J., Sener, O., Selman, B., Savarese, S., Saxena, A.  
2018; 40 (2): 467–81
- **Lattice Long Short-Term Memory for Human Action Recognition**  
Sun, L., Jia, K., Chen, K., Yeung, D., Shi, B. E., Savarese, S., IEEE  
IEEE.2017: 2166–75
- **Tracking The Untrackable: Learning to Track Multiple Cues with Long-Term Dependencies**  
Sadeghian, A., Alahi, A., Savarese, S., IEEE  
IEEE.2017: 300–311
- **Adversarially Robust Policy Learning: Active Construction of Physically-Plausible Perturbations**  
Mandlekar, A., Zhu, Y., Garg, A., Li Fei-Fei, Savarese, S., Bicchi, A., Okamura, A.  
IEEE.2017: 3932–39
- **Deep View Morphing**  
Ji, D., Kwon, J., McFarland, M., Savarese, S., IEEE  
IEEE.2017: 7092–7100
- **Feedback Networks**  
Zamir, A. R., Wu, T., Sun, L., Shen, W. B., Shi, B. E., Malik, J., Savarese, S., IEEE  
IEEE.2017: 1808–17
- **Robust real-time tracking combining 3D shape, color, and motion** *INTERNATIONAL JOURNAL OF ROBOTICS RESEARCH*  
Held, D., Levinson, J., Thrun, S., Savarese, S.  
2016; 35 (1-3): 30-49

- **Automatic Extrinsic Calibration of Vision and Lidar by Maximizing Mutual Information** *JOURNAL OF FIELD ROBOTICS*  
Pandey, G., McBride, J. R., Savarese, S., Eustice, R. M.  
2015; 32 (5): 696-722
- **Indoor Scene Understanding with Geometric and Semantic Contexts** *INTERNATIONAL JOURNAL OF COMPUTER VISION*  
Choi, W., Chao, Y., Pantofaru, C., Savarese, S.  
2015; 112 (2): 204-220
- **Relating Things and Stuff via Object Property Interactions** *IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE*  
Sun, M., Kim, B., Kohli, P., Savarese, S.  
2014; 36 (7): 1370-1383
- **Relating Things and Stuff via ObjectProperty Interactions.** *IEEE transactions on pattern analysis and machine intelligence*  
Min Sun, Byung-Soo Kim, Kohli, P., Savarese, S.  
2014; 36 (7): 1370-1383
- **Understanding Collective Activities of People from Videos** *IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE*  
Choi, W., Savarese, S.  
2014; 36 (6): 1242-1257
- **A Bayesian generative model for learning semantic hierarchies** *FRONTIERS IN PSYCHOLOGY*  
Mittelman, R., Sun, M., Kuipers, B., Savarese, S.  
2014; 5
- **Beyond PASCAL: A Benchmark for 3D Object Detection in the Wild**  
Xiang, Y., Mottaghi, R., Savarese, S.  
2014
- **Monocular Multiview Object Tracking with 3D Aspect Parts** *13th European Conference on Computer Vision (ECCV)*  
Xiang, Y., Song, C., Mottaghi, R., Savarese, S.  
SPRINGER-VERLAG BERLIN.2014: 220–235
- **A Hierarchical Representation for Future Action Prediction** *13th European Conference on Computer Vision (ECCV)*  
Lan, T., Chen, T., Savarese, S.  
SPRINGER INT PUBLISHING AG.2014: 689–704
- **Relating Things and Stuff via Object Property Interactions.** *IEEE transactions on pattern analysis and machine intelligence*  
Sun, M., Kim, B., Kohli, P., Savarese, S.  
2013: -?
- **Layout Estimation of Highly Cluttered Indoor Scenes using Geometric and Semantic Cues**  
Chao, Y. -W., Choi, W., Pantofaru, C., Savarese, S.  
2013
- **Find the Best Path: an Efficient and Accurate Classifier for Image Hierarchies** *IEEE International Conference on Computer Vision (ICCV)*  
Sun, M., Huang, W., Savarese, S.  
IEEE.2013: 265–272
- **3D Scene Understanding by Voxel-CRF** *IEEE International Conference on Computer Vision (ICCV)*  
Kim, B., Kohli, P., Savarese, S.  
IEEE.2013: 1425–1432
- **Breaking the chain: liberation from the temporal Markov assumption for tracking human poses** *IEEE International Conference on Computer Vision (ICCV)*  
Tokola, R., Choi, W., Savarese, S.  
IEEE.2013: 2424–2431
- **Object Detection by 3D Aspectlets and Occlusion Reasoning** *IEEE International Conference on Computer Vision Workshops (ICCVW)*  
Xiang, Y., Savarese, S.  
IEEE.2013: 530–537

- **Free your Camera: 3D Indoor Scene Understanding from Arbitrary Camera Motion** *24th British Machine Vision Conference*  
Furlan, A., Miller, S., Sorrenti, D. G., Fei-Fei, L., Savarese, S.  
B M V A PRESS.2013
- **Accurate Localization of 3D Objects from RGB-D Data using Segmentation Hypotheses**  
Kim, B., Xu, S., Savarese, S.  
2013
- **Breaking the chain: liberation from the temporal Markov assumption for tracking human poses**  
Tokola, R., Choi, W., Savarese, S.  
2013
- **Dense Object Reconstruction Using Semantic Priors**  
Bao, Y., Chandraker, M., Lin, Y., Savarese, S.  
2013
- **Free your Camera: 3D Indoor Scene Understanding from Arbitrary Camera Motion**  
Furlan, A., Miller, S., Sorrenti, D., G., Fei-Fei, L., Savarese, S.  
2013
- **Learning Hierarchical Linguistic Descriptions of Visual Datasets** *NAACL-HLT Workshop on Vision and Language*  
Mittelman, R., Sun, M., Kuipers, B., Savarese, S.  
2013
- **Find the Best Path: an Efficient and Accurate Classifier for Image Hierarchies**  
Sun, M., Huang, W., Savarese, S.  
2013
- **Understanding Indoor Scenes using 3D Geometric Phrases**  
Choi, W., Chao, Y. -W., Pantofaru, C., Savarese, S.  
2013
- **Weakly Supervised Learning of Mid-Level Features with Beta-Bernoulli Process Restricted Boltzmann Machines**  
Mittelman, R., Lee, H., Kuipers, B., Savarese, S.  
2013
- **Recognizing Complex Human Activities via Crowd Context** *Augmented Vision and Reality*  
Choi, W., Savarese, S.  
Springer.2013: 1
- **Object Detection by 3D Aspectlets and Occlusion Reasoning** *in the 4th International IEEE Workshop on 3D Representation and Recognition (3dRR)*  
Xiang, Y., Savarese, S.  
2013
- **Label Transfer Exploiting Three-dimensional Structure for Semantic Segmentation**  
Garro, V., Fusiello, A., Savarese, S.  
2013
- **3D Scene Understanding by Voxel-CRF**  
Kim, B., Kohli, P., Savarese, S.  
2013
- **Object detection, shape recovery, and 3D modelling by depth-encoded hough voting** *in Computer Vision and Image Understanding (CVIU)*  
Sun, M., Kumar, S., S., Bradski, G., Savarese, S.  
2013
- **Automatic targetless extrinsic calibration of a 3d lidar and camera by maximizing mutual information**  
Pandey, G., McBride, J., R., Savarese, S., Eustice, R., M.  
2012

- **Mobile Object Detection through Client-Server based Vote Transfer**  
Kumar, S., Sun, M., Savarese, S.  
2012
- **Multimodality video indexing and retrieval using directed information** *IEEE Transactions on Multimedia*  
Chen, X., Hero, A., Savarese, S.  
2012; 14 (1)
- **Object Detection using Geometrical Context Feedback** *International Journal of Computer Vision*  
Sun, M., Bao, S., Ying-Ze, Savarese, S.  
2012; 2
- **An Efficient Branch-and-Bound Algorithm for Optimal Human Pose Estimation**  
Sun, M., Telaprolu, M., Lee, H., Savarese, S.  
2012
- **Relating Things and Stuff by High-Order Potential Modeling** *ECCV 2012 Workshop on Higher-Order Models and Global Constraints in Computer Vision (HiPot)*.  
Bao, Y., Xiang, Y., Savarese, S.  
2012
- **Estimating the Aspect Layout of Object Categories**  
Xiang, Y., Savarese, S.  
2012
- **Structure From Motion with Points, Objects, and Regions**  
Bao, Y., Bagra, M., Chao, Y. -W., Savarese, S.  
2012
- **Toward Mutual Information based Automatic Registration of 3D Point Clouds**  
Pandey, G., McBride, J., Savarese, S., Eustice, R.  
2012
- **A Unified Framework for Multi-Target Tracking and Collective Activity Recognition**  
Choi, W., Savarese, S.  
2012
- **Model-based object recognition** *Encyclopedia of Computer Vision*  
Sun, M., Savarese, S.  
Springer.2012: 1
- **Object Co-detection**  
Bao, Y., Xiang, Y., Savarese, S.  
2012
- **3D Shape from Specular Reflections** *Encyclopedia of Computer Vision*  
Savarese, S.  
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- **MVSS: Michigan Visual Sonification System**  
Clemons, J., Bao, Y., Sharma, V., Savarese, S., Austin, T.  
2012
- **Scene Understanding for the Visually Impaired Using Visual Sonification by Visual Feature Analysis and Auditory Signature**  
Clemons, J., Bao, Y., Bagra, M., Austin, T., Savarese, S.  
2012
- **Efficient and Exact MAP Inference using Branch and Bound**  
Sun, M., Telaprolu, M., Lee, H., Savarese, S.  
2012

- **Research in Visualization Techniques for Field Construction** *JOURNAL OF CONSTRUCTION ENGINEERING AND MANAGEMENT-ASCE*  
Kamat, V. R., Martinez, J. C., Fischer, M., Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2011; 137 (10): 853-862
- **Toward coherent object detection and scene layout understanding** *Image and Vision Computing*  
Bao, S., Yingze, Sun, M., Savarese, S.  
2011; 9
- **Visually Bootstrapped generalized ICP**  
Pandey, G., McBride, James, R., Savarese, S., Eustice, Ryan, M.  
2011
- **EFFEX: An Embedded Processor for Computer Vision Based Feature Extraction**  
Clemons, J., Savarese, S., Austin, T.  
2011
- **Deformable Part Models Revisited: A Performance Evaluation for Object Category Pose Estimation** *IEEE Workshop on Challenges and Opportunities in Robot Perception (in conjunction with ICCV-11)*.  
Lopez, R., Tuytelaars, T., Savarese, S.  
2011
- **Monitoring Changes of 3D Building Elements from Unordered Photo Collections** *IEEE workshop on Computer Vision for Remote Sensing of the Environment (in conjunction with ICCV-11)*.  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2011
- **Learning Context for Collective Activity Recognition**  
Choi, W., Shahid, K., Savarese, S.  
2011
- **Semantic Structure from Motion**  
Bao, S., Yingze, Savarese, S.  
2011
- **MEVBench: A Mobile Computer Vision Benchmarking Suite**  
Clemons, J., Zhu, H., Savarese, S., Austin, T.  
2011
- **Visualization of Construction Progress Monitoring using Unordered Construction Photo Collections and 4D Building Information Models** in *"Augmented Reality"*, ISBN 978-953-307-631-7  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2011: 1
- **Toward Automatic 3D Generic Object Modeling from One Single Image** *3DIM-PVT*  
Sun, M., Kumar, S.  
2011
- **Semantic Structure From Motion with Object and Point Interactions** *IEEE Workshop on Challenges and Opportunities in Robot Perception (in conjunction with ICCV-11)*.  
Bao, S., Yingze, Bagra, M., Savarese, S.  
2011
- **Hierarchical Classification of Images by Sparse Approximation**  
Kim, B., Park, J., Gilbert, A., Savarese, S.  
2011
- **Articulated Part-based Model for Joint Object Detection and Pose Estimation**  
Sun, M., Savarese, S.  
2011

- **Integrated Sequential As-Built and As-Planned Representation with D4AR Tools in Support of Decision-Making Tasks in the AEC/FM Industry** *ASCE Journal of Construction Engineering and Management*  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2011
- **Robust Object Pose Estimation via Statistical Manifold Modeling**  
Mei, L., Liu, J., Hero, A., Savarese, S.  
2011
- **Representations and Techniques for 3D Object Recognition and Scene Interpretation** *Synthesis lecture on Artificial Intelligence and Machine Learning*  
Hoiem, D., Savarese, S.  
Morgan Claypool Publishers.2011: 1
- **Recognizing Human Actions by Attributes**  
Liu, J., Kuipers, B., Savarese, S.  
2011
- **Cross-View Action Recognition via View Knowledge Transfer**  
Liu, J., Shah, M., Kuipers, B., Savarese, S.  
2011
- **Detecting and Tracking People using an RGB-D Camera via Multiple Detector Fusion** *Workshop on Challenges and Opportunities in Robot Perception (in conjunction with ICCV-11)*.  
Choi, W., Pantofaru, C., Savarese, S.  
2011
- **A computer analysis of the mirror in Hans Memling's Virgin and Child and Maarten van Nieuwenhove** *Digital Imaging for Cultural Heritage Preservation*  
Savarese, S., Stork, D., G., DelPozo, A., Spronk, R.  
CRC Press.2011: 1
- **Multi-view Object Categorization and Pose Estimation** *Computer Vision: Detection, Recognition and Reconstruction (Studies in Computational Intelligence)*  
Savarese, S., Fei-Fei, L.  
Springer.2010: 1
- **Remote assessment of pre and post-disaster critical physical infrastructures using segway mobile workstation chariot and D4AR 4D augmented reality models.**  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2010
- **Automated model component-based recognition of progress using daily construction photographs and 4D IFC-based models.**  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2010
- **D4AR 4 Dimensional augmented reality - tools for automated remote progress tracking and support of decision-enabling tasks in the AEC/FM industry**  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2010
- **Depth-Encoded Hough Voting for Joint Object Detection and Shape Recovery**  
Sun, M., Bradsy, G., Xu, B., Savarese, S.  
2010
- **CEC: Research in Visualization Techniques for Field Construction**  
Kamat, V., Martinez, J., Fischer, M., Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2010
- **D4AR - 4 DIMENSIONAL AUGMENTED REALITY - MODELS FOR AUTOMATION AND INTERACTIVE VISUALIZATION OF CONSTRUCTION PROGRESS MONITORING**  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2010

- **Extrinsic calibration of a 3d laser scanner and an omnidirectional camera.**  
Pandey, G., McBride, J., Savarese, S., Eustice, R.  
2010
- **Toward automated generation of parametric BIMs based on hybrid video and laser scanning data.** *In Journal of Advanced Engineering Informatics*  
Brilakis, I., Lourakis, M., Sacks, R., Savarese, S., Christodoulou, S., Teizer, J.  
2010; 4 (24): 456-465
- **Model-based detection of progress using D4AR - A 4 Dimensional augmented reality- models generated by daily site photologs and building information models**  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2010
- **Toward Coherent Object Detection And Scene Layout Understanding**  
Bao, S., Yingze, Sun, M., Savarese, S.  
2010
- **Multiple Target Tracking in World Coordinate with Single, Minimally Calibrated Camera**  
Choi, W., Savarese, S.  
2010
- **Object Detection with Geometrical Context Feedback Loop**  
Sun, M., Ying-Ze, S., Savarese, S.  
2010
- **Learning a dense multi-view representation for detection, viewpoint classification and synthesis of object categories** *12th IEEE International Conference on Computer Vision*  
Hao Su, S., Min Sun, S., Li Fei-Fei, F. F., Savarese, S.  
IEEE.2009: 213–220
- **A Multi-View Probabilistic Model for 3D Object Classes.**  
Sun, M., Su, H., Savarese, S., Fei-Fei, L.  
2009
- **Monitoring of Construction Performance Using Daily Progress Photograph Logs and 4D As-Planned Models**  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2009
- **What are they doing? : Collective Activity Classification Using Spatio-Temporal Relationship Among People**  
Choi, W., Shahid, K., Savarese, S.  
2009
- **D4AR- A 4-Dimensional Augmented Reality Model for Automating Construction Progress Data Collection**  
Golparvar-Fard, M., Pena-Mora, F.  
2009
- **Unsupervised Object Pose Classification from Short Video Sequences**  
Mei, L., Sun, M., Carter, K., M., Hero III, A., O., Savarese, S.  
2009
- **Sparse Reconstruction and Geo-Registration of Daily Site Photographs for Representation of As-Built Construction Scene and Automatic Construction Progress Data Collection**  
Golparvar-Fard, M., Pena-Mora, F., Savarese, S.  
2009
- **Scene Categorization from Low Definition Video**  
Gupta, P., Arrabolu, S., Brown, M., Savarese, S.  
2009
- **Interactive Visual Construction Progress Monitoring with 4D Augmented Reality Model**



- Golparvar-Fard, M., Savarese, S., Pena-Mora, F.  
2009
- **View synthesis for recognizing unseen poses of object classes.**  
Savarese, S., Fei-Fei, L.  
2008
  - **Why do we see some surfaces as reflective?**  
Poza, A., Del, Savarese, S., Baker, D., Simons, D., J.  
2008
  - **When are reflections useful in perceiving the shape of shiny surfaces?**  
Savarese, S., Poza, A., Del, Baker, D., Simons, D., J.  
2008
  - **Spatial-Temporal Correlations for Unsupervised Action Classification**  
Savarese, S., Poza, A., Del, Niebles, J. C., Fei-Fei, L.  
2008
  - **Reflections on praxis and facture in a devotional portrait diptych: A computer analysis of the mirror in Hans Memling's Virgin and Child and Maarten van Nieuwenhove**  
Savarese, S., Spronk, R., Stork, D., G., DelPoza, A.  
2008
  - **Interactive Visual Construction Progress Monitoring with 4D Augmented Reality Model** *CCBE-XI*  
Fard, M., Golparvar, Savarese, S., Pena-Mora, F.  
2008
  - **Detecting Specular Surfaces on Natural Images**  
DelPoza, A., Savarese, S.  
2007
  - **Carving from ray-tracing constraints: IRT-carving**  
Andreetto, M., Savarese, S., Perona, P.  
2006
  - **Discriminative Object Class Models of Appearance and Shape by Correlatons**  
Savarese, S., Winn, J., Criminisi, A.  
2006
  - **3D Reconstruction by Shadow Carving: Theory and Practical Evaluation** *International Journal of Computer Vision (IJCV)*  
Savarese, S., Andreetto, M., Rushmeier, H.  
2006; 3 (71): 305-336
  - **Local Shape from Mirror Reflections** *International Journal of Computer Vision (IJCV)*  
Savarese, S., Chen, M., Perona, P.  
2005; 1 (64): 31-67
  - **What do reflections tell us about the shape of a mirror?** *in Applied Perception in Graphics and Visualization [sponsored by ACM SIGGRAPH]*  
Savarese, S., Fei-Fei, L., Perona, P.  
2004: 115-118
  - **Recovering local shape of a mirror surface from reflection of a regular gridI**  
Savarese, S., Chen, M., Perona, P.  
2004
  - **Can We See the Shape of a Mirror?**  
Savarese, S., Fei-Fei, L., Perona, P.  
2003

- **Implementation of a Shadow Carving System for Shape Capture**  
Savarese, S., Rushmeier, H., Bernardini, F., Perona, P.  
2002
- **Local Analysis for 3D Reconstruction of Specular Surfaces -- part II**  
Savarese, S., Perona, P.  
2002
- **Second Order Local Analysis for 3D Reconstruction of Specular Surfaces**  
Savarese, S., Chen, M., Perona, P.  
2002
- **Local Analysis for 3D Reconstruction of Specular Surfaces**  
Savarese, S., Perona, P.  
2001
- **Shadow Carving**  
Savarese, S., Rushmeier, H., Bernardini, F., Perona, P.  
2001