Yi Ren

Assistant Professor, Barrett Honors Faculty
Mechanical Engineering, Arizona State University
email | website | google scholar

Education

University of Michigan, Ann Arbor, MI 2012
Ph.D. , Mechanical Engineering
Advisor: Panos Y. Papalambros
Committee: Noburu Kikuchi, Richard Gonzalez, George Michailidis
Thesis: *Design Preference Elicitation, Identification and Estimation*

University of Michigan, Ann Arbor, MI 2009
Master of Science, Mechanical Engineering

Tsinghua University, Beijing, China 2007
Bachelor of Engineering, Automotive Engineering

Research Interests

Design optimization, Robust machine learning

Employment

Arizona State University, Tempe, AZ Jan. 2015 - present
Assistant Professor, Mechanical Engineering

University of Michigan, Ann Arbor, MI 2012 - 2014
Research Fellow, Optimal Design Laboratory

Awards

Amazon AWS Machine Learning Research Award (2019)
Best Paper Award (2nd place) at the ASCE International Workshop on Computing in Civil Engineering (2017, with C. Zhang, P. Tang, and P. Liao)
Best Paper Award on Design Automation at the International Design Engineering Technical Conferences (2015, with A.E. Bayrak and P.Y. Papalambros)
Outstanding Undergraduate Thesis, Tsinghua University (2007)
Honeywell Scholarship, Tsinghua University (2004)

Publications and Presentations

LEGEND (to be added at the beginning of the Publications section)

(*) Corresponding Author

Bold Font: My Ph.D. Student

Underline: My Master's Student

(+) Equal Contributions

~ Presentation

Journal articles published, in press, or accepted

[1] **Cang, R.**, **Yao, H.**, Ren, Y.*, "One-shot generation of near-optimal topology through theory-driven machine learning", *Computer-Aided Design*, 109, 12-21, 2019.

[2] Chen, P., Xu, W., Chawla, N., Ren, Y., and Jiao, Y.*. "Hierarchical n-point polytope functions for quantitative representation of complex heterogeneous materials and microstructural evolution." Acta Materialia 179 (2019): 317-327.

[3] Zhang, C., Liao, P., Tang, P.*****, Ren, Y., "A New Crowdsourcing Approach for Rule-Based Hazard Detection in Complex Construction Workspaces", *Advanced Engineering Informatics*, 2019. (accepted)

[4] Wang, Y., Elliott, S., Ren, Y.*, Zhang, W., "Enabling Courteous Vehicle Interactions through Game-based and Dynamics-aware Intent Inference", *IEEE Transactions on Intelligent Vehicles*, 2019. (accepted)

[5] **Cang, R.**, **Li, H.**, **Yao, H.**, Jiao, Y., Ren, Y.* "Improving Direct Physical Properties Prediction of Heterogeneous Materials from Imaging Data via Convolutional Neural Network and a Morphology-Aware Generative Model", *Computational Materials Science*, 150, 212-221.

[6] **Cahill, N.**, Sugar, T.*, Ren, Y., Schroeder, K., "Optimal Stiffness Design for Parallel Compliance in Robotic Limbs", *ASME Journal of Mechanisms and Robotics,* 10(3), 031014, 2018.

[7] Sexton, T., and Ren, Y.*, "Learning an Optimization Algorithm through Human Design Iterations", *ASME Journal of Mechanical Design*, 139(10), 101404, 2017.

[8] **Cang, R.**, **Xu, Y.**, **Chen, S.**, Liu, Y., Jiao, Y., and Ren, Y.*, "Microstructure Representation and Reconstruction of Heterogeneous Materials via Deep Belief Network for Computational Material Design", *ASME Journal of Mechanical Design*, 139(7), 071404, 2017.

[9] Ren, Y.*, Bayrak, A., and Papalambros, P. Y., "Ecoracer: Optimal Design and Control of Electric Vehicles Using Human Game Players", *ASME Journal of Mechanical Design*, 138(6), 2016.

[10] Kang, N.*****, Ren, Y., Feinberg, F. M., and Papalambros, P. Y., "Public Investment and Electric Vehicle Design: a Model-Based Market Analysis Framework with Application to a USA-China Comparison Study", *Design Science*, 2, e6, 2016.

[11] Bayrak, A.*****, Ren, Y., and Papalambros, P. Y., "Topology Generation for Hybrid Electric Vehicle

Architecture Design", *ASME Journal of Mechanical Design*, 138(8), 2016.

[12] Burnap, A.*****, Pan, Y., Liu, Y., Ren, Y., Lee, H., Gonzalez, R., and Papalambros, P. Y. "Improving Design Preference Prediction Accuracy using Feature Learning", *ASME Journal of Mechanical Design*, 138(7), 2016.

[13] Burnap, A.*****, Ren, Y., Papalambros, P. Y., Gonzalez, R. and Gerth, R., "When Crowdsourcing Fails: A Study of Expertise on Crowdsourced Design Evaluation", *ASME Journal of Mechanical Design*, volume 137, issue 3, 2015.

[14] Ren, Y.* and Papalambros, P. Y., "A Design Preference Elicitation Query as an Optimization Process", *ASME Journal of Mechanical Design*, volume 133, issue 11, 2011.

Articles submitted or in revision

[1] Kang, N.*****+, Ren, Y.+, Feinberg, F., and Papalambros, P. Y., "Form + Function: Optimizing Aesthetic Product Design via Adaptive, Geometrized Preference Elicitation", *Marketing Science*. (under review)

[2] **Yao, H.**, Wang, Z., Nie, G., Mazboudi, Y., Yang, Y., Ren, Y.*, "Improving Model Robustness with Transformation-Invariant Attacks", *AAAI 2020*. (under review)

Refereed Conference Papers

[1] Ren, Y.*, Elliott, S., Wang, Y., Yang, Y., Zhang, W., "How Shall I Drive? Interaction Modeling and Motion Planning towards Empathetic and Socially-Graceful Driving", *IEEE International Conference on Robotics and Automation (ICRA)*, 2019.

[2] **Yao, H.**, Regan, M., Yang, Y., Ren, Y.*, "Robust Image Classification through Generation", *IEEE International Conference on Image Processing (ICIP)*, 2019.

[3] **Yao, H.***+, Wen, J.*+, Ren, Y., Wu, B., Ji, Z., "Low-Cost Measurement Of Industrial Shock Signals Via Deep Learning Calibration", *IEEE International Conference on Acoustics, Speech, and Signal Processing*, 2019.

[4] **Yao, H.**, Ren, Y.*, Liu, Y., "FEA-Net: A Deep Convolutional Neural Network With Physics Prior For Efficient Data Driven PDE Learning", *AIAA Science and Technology Forum and Exposition*, 2019.

[5] Guo, T., Lohan, D., **Cang, R.**, Ren, Y., Allison, J.*, "An Indirect Design Representation for Topology Optimization Using Variational Autoencoder and Style Transfer", *AIAA Science and Technology Forum and Exposition*, 2018.

[6] Zhang, W.*, Yang, Y., and Ren, Y., "Towards Understanding Human Decisions in Human-robot Interactions", *In Proceedings of the ASME Dynamic Systems and Control Conference*, 2017.

[7] Ren, Y.*, **Yao, H.**, and Lin, X., "Topology Optimization of Structural Systems Considering both Compliance and Input Observability", *In Proceedings of the ASME Dynamic Systems and Control Conference*, 2017.

[8] **Zhang, C.**, Tang, P.*, Liao, P., and Ren, Y., "Imagery-Based Risk Assessment Using Crowdsourcing Technology in Complex Construction Sites", *In Proceedings of the ASCE International Workshop on Computing in Civil Engineering*, 2017. (**best paper award, 2nd place**)

[9] **Cahill, N.**, Ren, Y., and Sugar, T.*, "Mechanical Specialization of Robotic Limbs", *In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, 2017.

[10] **Cang, R.**, Vipradas, A., and Ren, Y.*, "Scalable Microstructure Reconstruction with Multi-Scale Pattern Preservation", *In Proceedings of the ASME 2017 International Design Engineering Technical Conferences and Computers and Information in Engineering Conferences*, 2017.

[11] **Yao, H.**, and Ren, Y.*, "Impressionist: A 3D Peekaboo Game for Crowdsourcing Shape Saliency", *In Proceedings of the ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conferences*, 2016.

[12] **Cang, R.**, and Ren, Y.*, "Deep Network-based Feature Extraction and Reconstruction of Complex Material Microstructures", *In Proceedings of the ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conferences*, 2016.

[13] Sexton, T., and Ren, Y.*, "Learning Human Search Strategies from a Crowdsourcing Game", *In Proceedings of the ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conferences*, 2016.

[14] Ren, Y.*, Bayrak, A., and Papalambros, P. Y., "Ecoracer: Optimal Design and Control of Electric Vehicles Using Human Game Players", *In Proceedings of the ASME 2015 International Design Engineering Technical Conferences*, DETC2015-46836, 2015. (**best paper award**)

[15] Kang, N.*, Emmanoulopoulos, M., Ren, Y., Feinberg, F. M., and Papalambros, P. Y., "A Framework for Quantitative Analysis of Government Policy Influence on Electric Vehicle Market", *In Proceedings of the International Conference on Engineering Design*, 2015.

[16] Burnap, A.*, Barto, C., Johnson-Roberson, M., Ren, Y., Gonzalez, R., and Papalambros, P. Y., "Crowdsourcing for Search of Disaster Victims: A Preliminary Study for Search System Design", *In Proceedings of the International Conference on Engineering Design*, 2015.

[17] Burnap, A.*, Ren, Y., Lee, H., Gonzalez, R., and Papalambros, P. Y., "Improving Preference Prediction Accuracy with Feature Learning", *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2014-35440, 2014.

[18] Bayrak, A. E.*, Ren, Y., and Papalambros, P. Y., "Optimal Dual-Mode Hybrid Electric Vehicle Powertrain Architecture Design for a Variety of Loading Scenarios", *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2014-34897, 2014.

[19] Ren, Y.*, and Papalambros, P. Y., "Enhanced Adaptive Choice-Based Conjoint Analysis Incorporating Engineering Knowledge", *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2014-34790, 2014.

[20] Ren, Y.*, Scott, C. and Papalambros, P. Y., "A Scalable Preference Elicitation Algorithm Using Group Generalized Binary Search", *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2013-13059, 2013.

[21] Burnap, A.*, Ren, Y., Papalambros, P. Y., Gonzalez, R. and Gerth, R., "A Simulation Based Estimation of Crowd Ability and its Influence on Crowdsourced Evaluation of Design Concepts", *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2013-13020, 2013.

[22] Bayrak, A. E.*, Ren, Y., and Papalambros, P. Y., “Optimal Design of Hybrid-Electric Vehicle Architectures Using Auto-Generation of Feasible Driving Modes”, *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2013-13043, 2013.

[23] Ren, Y.*, Burnap, A. and Papalambros, P. Y., “Quantification of Perceptual Design Attributes Using a Crowd”, *In Proceedings of the 19th International Conference on Engineering Design*, 2013.

[24] Ren, Y*. and Papalambros, P. Y., “On the Use of Active Learning in Engineering Design”, *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2012-70624, 2012.

[25] Ren, Y*. and Papalambros, P. Y., “On Design Preference Elicitation with Crowd Implicit Feedback”, *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2012-70605, 2012.

[26] Ren, Y*. and Papalambros, P. Y., "Design Preference Elicitation: Exploration and Learning", *In Proceedings of the 18th International Conference on Engineering Design*, volume 10, page 149-158, 2011.

[27] Ren, Y*. and Papalambros, P. Y., "Design Preference Elicitation Using Efficient Global Optimization", *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2011-48316, 2011.

[28] Ren, Y*. and Papalambros, P. Y., "Design Preference Elicitation, Derivative-Free Optimization and Support Vector Machine Search", *In Proceedings of the ASME International Design Engineering Technical Conferences*, DETC2010-28475, 2010.

Presentations

Invited Seminar – External

“Engineering Design as a Test Ground for AI Research”, University of California, Davis, May. 1, 2019.
“AI Standards in Model-Based Enterprise”, NIST, Gaithersburg, Feb. 26, 2019.
“Engineering Design as a Test Ground for AI Research”, University of Nevada, Reno, Apr. 27, 2018.

Invited Seminar – ASU Internal

“Engineering Design as a Test Ground for AI Research”, SEMTE Seminar, Feb. 15, 2019.
“Design Science On the intersection of engineering design and machine learning”, SEMTE Seminar, Sept. 16, 2016.

Peer-reviewed Conference Presentations

[1] **Cang, R.~**, Ren, Y., and Yang Jiao, “Improving Direct Physical Properties Prediction of Heterogeneous Materials from Imaging Data via Convolutional Neural Network and a Morphology-Aware Generative Model”, *2018 SIAM Conference on Mathematical Aspects of Materials Science (MS18)*, 2018

[2] Guo, T., Lohan, D., **Cang, R.**, Ren, Y.~, and Allison, J., “An Indirect Design Representation for Topology Optimization Using Variational Autoencoder and Style Transfer”, *AIAA Science and*

Technology Forum and Exposition, 2018.

[3] Ren, Y.~, **Houpu, Y.**, and Xinfan, L., "Topology Optimization of Structural Systems Considering both Compliance and Input Observability", *ASME Dynamic Systems and Control Conference*, 2017.

[4] **Cahill, N.**~, Ren, Y., and Sugar, T., "Mechanical Specialization of Robotic Limbs", *In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, 2017.

[5] **Cang, R.**~, and Ren, Y., "Scalable Microstructure Reconstruction with Multi-Scale Pattern Preservation", *ASME 2017 International Design Engineering Technical Conferences*, 2017.

[6] **Yao, H.**~, and Ren, Y., "Impressionist: A 3D Peekaboo Game for Crowdsourcing Shape Saliency", *ASME 2016 International Design Engineering Technical Conferences*, 2016.

[7] **Cang, R.**~, and Ren, Y., "Deep Network-based Feature Extraction and Reconstruction of Complex Material Microstructures", *ASME 2016 International Design Engineering Technical Conferences*, 2016.

[8] Sexton, T., and Ren, Y.~, "Learning Human Search Strategies from a Crowdsourcing Game", *ASME 2016 International Design Engineering Technical Conferences*, 2016.

[9] Ren, Y.~, Bayrak, A., and Papalambros, P. Y., "Ecoracer: Optimal Design and Control of Electric Vehicles Using Human Game Players", *ASME International Design Engineering Technical Conferences*, 2015. (**best paper award**)

[10] Ren, Y.~ and Papalambros, P. Y., "Enhanced Adaptive Choice-Based Conjoint Analysis Incorporating Engineering Knowledge", *ASME International Design Engineering Technical Conferences*, 2014.

[11] Ren, Y.~, Scott, C. and Papalambros, P. Y., "A Scalable Preference Elicitation Algorithm Using Group Generalized Binary Search", *ASME International Design Engineering Technical Conferences*, 2013.

[12] Burnap, A., Ren, Y.~, Papalambros, P. Y., Gonzalez, R. and Gerth, R., "A Simulation Based Estimation of Crowd Ability and its Influence on Crowdsourced Evaluation of Design Concepts", *ASME International Design Engineering Technical Conferences*, 2013.

[13] Bayrak, A. E., Ren, Y.~, and Papalambros, P. Y., "Optimal Design of Hybrid-Electric Vehicle Architectures Using Auto-Generation of Feasible Driving Modes", *ASME International Design Engineering Technical Conferences*, 2013.

[14] Ren, Y.~ and Papalambros, P. Y., "On the Use of Active Learning in Engineering Design", *ASME International Design Engineering Technical Conferences*, 2012.

[15] Ren, Y.~ and Papalambros, P. Y., "On Design Preference Elicitation with Crowd Implicit Feedback", *ASME International Design Engineering Technical Conferences*, 2012.

[16] Ren, Y.~ and Papalambros, P. Y., "Design Preference Elicitation: Exploration and Learning", *the 18th International Conference on Engineering Design*, 2011.

[17] Ren, Y.~ and Papalambros, P. Y., "Design Preference Elicitation Using Efficient Global Optimization", *ASME International Design Engineering Technical Conferences*, 2011.

[18] Ren, Y.~ and Papalambros, P. Y., "Design Preference Elicitation, Derivative-Free Optimization and Support Vector Machine Search", *ASME International Design Engineering Technical Conferences*, 2010.

Professional Activities and Service

International/national conferences sessions organized
International Design Engineering Technical Conferences (2014, 2015)
International/national conference sessions chaired
ASME International Design Engineering Technical Conferences (2014, 2015, 2016, 2017)
ASME Dynamics Systems and Control Conference (2017)
Peer Reviewer
ASME Journal of Mechanical Design, IEEE Transactions on Vehicular Technology, IEEE Transactions on Automation Science and Engineering, IEEE Transactions on Knowledge and Data Engineering, Design Science Journal, Journal of Engineering Design, Journal of Artificial Intelligence for Engineering Design, Analysis and Manufacturing, Computer Aided Design, IIE Transactions, Applied Energy, ASME International Design Engineering Technical Conferences, International Conference on Engineering Design
Proposal Review Service
NSF, NASA, Singapore National Research Foundation

Mentoring and Teaching

Student Supervision / Mentoring
Ph.D. students – graduated **(2)**: Ruijin Cang (MAE), Nathan Cahill (MAE, co-advised with Professor Sugar, T.)
Ph.D. students – current **(1)**: Houpu Yao (MAE, will defend approx. Apr. 2019)
M.S. students –graduated **(5)**: Thurston Sexton (MAE, NIST), Aditya Vipradas (MAE, MSC Software), Adithya Venugopal (MAE), Saurabh Animesh (EE), Steven Elliott (MAE, Northrop Grumman)
M.S. students – current **(0)**:
Undergraduate students – current **(1)**: Benjamin Danek (FURI, CS)
Undergraduate students – graduated **(7)**: Paul Stobinske (MAE Honor thesis, Northrop Grumman), Fabian Gadau (MAE, Ford), Andrew Leaton (FURI, MAE, U. Colorado), Malcolm Regan (FURI, EE, PhD at NCST), Michael King (Honor thesis, MAE, Stanford), Xianfang Gu (FURI, EE), Patrick Kennedy (MAE)
High-school students **(2)**: Rajan Vivek (2017), Shreya Varra (2016)
Student fellowships and awards **(2)**: Best Honor Thesis (Paul Stobinske), NIST Summer Undergraduate Research Fellowship (Malcolm Regan)

Teaching
Undergraduate courses taught **(6)**: MAE301 Applied Statistics (Fall 2015, Spring 2019), MAE342 Mechanical Design (Spring 2018), ASU-101 The ASU Experience (Fall 2015, Fall 2017, Fall 2018)
Graduate courses taught **(5)**: MAE598/494 Design Optimization (Spring 2015, Spring 2016, Fall 2017, Fall 2018, new course), MAE540 Advanced Product Design (Spring 2017)