Seonho Park

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Research Interests

- Machine Learning, Stochastic Optimization, Uncertainty Quantification, Variational Inference

Education

University of Florida **Gainesville, FL.**
Ph.D. Industrial and Systems Engineering, *Aug. 2017-2021 (expected)*
Advisor: Dr. Panos M. Pardalos
Supervisory Committee Members: Dr. Jose C. Principe, Dr. Hongcheng Liu, Dr. Mostafa Reisi-Gahrooei
Dissertation title: Uncertainty-aware neural networks and applications

University of Florida **Gainesville, FL.**
M.S. Industrial and Systems Engineering, GPA: 3.93/4.0 *Dec. 2020*

Hanyang University **Seoul, South Korea**
M.S. Mechanical Engineering, GPA: 3.88/4.0 *Feb. 2012*
Thesis: Sequential Approximate Optimization using Dual Subproblems based on Diagonal Quadratic Approximation
Advisor: Dr. Dong-Hoon Choi

Hanyang University **Seoul, South Korea**
B.S. Mechanical Engineering, GPA: 3.81/4.0, summa cum laude *Feb. 2010*

Work Experiences

ERShares **Boston, MA. (work remotely)**
Quantitative Research Analyst *Dec. 2020 - Present*
- Apply mathematical and statistical techniques on data to generate investment insights
- Develop tools to optimize the firm's trading strategies and trading signals

Siemens Healthineers **Princeton, NJ.**
Medical Imaging Deep Learning Research Intern *May. 2019 - Aug. 2019*
- Research on active learning to quantify classification uncertainty to select Chest XRay images to be annotated
- Develop and deploy 3D ResNet architecture to classify rotator-cuff tears
- Mentors: Florin C. Ghesu, Sasa Grbic

PIDO Tech R&D CENTER **Seoul, South Korea**
Research Engineer *Oct. 2016 - July. 2017*
- Integrated machine learning algorithms including Gaussian process, deep neural networks, support vector machine, ensemble models into the commercial structural design optimization software

MIDAS IT R&D CENTER **Seong-Nam, South Korea**
Researcher, Section Manager *Jan. 2012 - May. 2016*
- Developed optimization algorithms to solve structural design optimization problems
- Developed reliability analysis module for commercial computer-aided engineering software
- Researched on diagonosis of Alzheimer's disease from fMRI T1 images using deep convolutional neural network

Research Experiences

Airforce Research Laboratory **Eglin AFB, FL.**
Research Assistant, Contract Number: FA8651-08-D-0108 *Aug. 2019 - Present*

- Research on using deep neural network based image matching and retrieval technique for positioning of unmanned aerial systems in GPS-denied environments
- The paper has been submitted to the journal, Inverse Inverse Problems & Imaging
- Now further working on fully utilizing the deep neural networks for whole procedure of positioning including reranking the retrieved SAR images and estimating homography between the query and retrieved SAR images
- Principal investigator: Maciej Rysz, Kaitlin L. Fair

Center for Applied Optimization, University of Florida **Gainesville FL.**
Research Assistant *Aug. 2017 - Present*

- Uncertainty-aware neural networks and applications (Current work for dissertation)
  - Research on measuring uncertainty inherent in both model and data that can be efficiently and effectively equipped with deep neural networks
  - Research on anomaly detection based on rate-distortion theory in information theory and variational autoencoder (VAE) and argue that using encoder-only architecture is enough to estimate the data distribution
  - Now working on estimating mutual information and its associated Radon-nikodym derivative to estimate the out-of-distribution
- Portfolio based on 10Ks document embedding and network (Current work)
  - Inspired by 'Lazy Price' insisting the descriptive changes in 10Ks negatively affect the stock price, but take some time to reflect, now, working on training the doc2vec model to generate 10K embedding vectors and construct the network whose edges correspond to cosine similarity of the vectors. Based on the observation in Lazy Price, argue that the long-short portfolio of stocks moving towards the center of the network over the recent two decades (1999-2019) generates statistically meaningful cumulative returns based on multi-factor models
- Stochastic optimization for training deep neural networks (Done by Aug. 2019)
  - Research on combining negative curvature with the adaptive cubic regularized Newton method for solving nonconvex finite-sum functions that typically arise in machine learning problems
  - The associated paper has been published in the journal, Journal of optimization theory and applications

Awards and Honors

QSR Data Challenge Competition Finalist, *Quality, Statistics and Reliability (QSR) Section of INFORMS* **2020**
COVID19 CT Scan images classification competition, top 4 among 50 participants

KSEA-GFC Scholarship, *Korean-American Scientists and Engineers Association* **2020**
Awarded in recognition of outstanding research in STEM area and/or dedicated service for KSEA-GFC

Korean Scholastic Excellence Award, *Herbert Wertheim College of Engineering, University of Florida* **2019**
Awarded in recognition of scholastic excellence in graduate studies

Publications

1. **Seonho Park**, Maciej Rysz, Kaytlin L. Fair, Panos M. Pardalos, *SAR Image-based Positioning in GPS-denied Environments using Deep Cosine Similarity Neural Networks* , Inverse Problems & Imaging (Accepted), 2020
2. **Seonho Park**, George Adosoglou, Panos M. Pardalos, *Interpreting Rate-Distortion of Variational Autoencoder and Using Model Uncertainty for Anomaly Detection*, Preprint *[pdf] [code]*, Annals of Mathematics and Artificial Intelligence (Accepted), 2020
3. **Seonho Park**, Seung Hyun Jeong, Panos M. Pardalos, *Combining Stochastic Adaptive Cubic Regularization with Negative Curvature for Nonconvex Optimization [paper] [code]*, Journal of optimization theory and applications, 184, pp. 953–971, 2020
4. **Seonho Park**, Seung Hyun Jeong, Gil Ho Yoon, Albert A. Groenwold, Dong-Hoon Choi, *A globally convergent sequential convex programming using an enhanced two-point diagonal quadratic approximation for structural optimization*, Structural and Multidisciplinary Optimization 50 (5), pp.739-753, 2014
5. Seung Hyun Jeong, **Seonho Park**, Dong-Hoon Choi, Gil Ho Yoon, *Toward a stress-based topology optimization procedure with indirect calculation of internal finite element information*, Computers & Mathematics with Applications 66 (6), pp.1065-1081, 2013
6. Seung Hyun Jeong, **Seonho Park**, Dong-Hoon Choi, Gil Ho Yoon, *Topology optimization considering static failure theories for ductile and brittle materials*, Computers & Structures, 110, pp.116-132, 2012

Talks

1. *Uncertainty-aware Neural Networks For Medical Image Analysis*, INFORMS annual meeting, Seattle, Washington, 20-23 Oct. 2019
2. *Stochastic Adaptive Cubic Regularization with Negative Curvature for Nonconvex Optimization*, INFORMS annual meeting, Seattle, Washington, 20-23 Oct. 2019
3. *Diagnosis of Alzheimer's disease with deep learning*, Hanyang University, 4 Jul. 2016
4. *A filtered Sequential Approximate Optimization Algorithm based on Dual Subproblems using an Enhanced Two-point Diagonal Quadratic Approximation for Structural Optimization*, 12th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference and 14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Indianapolis, Indiana, 17-19 Sep. 2012
5. *Development of External Module for Stress-based Topology Optimization using Commercial CAE Software Package*, The 7th China-Japan-Korea Joint Symposium on Optimization of Structural and Mechanical Systems, Huangshan, China, 18-21 Jun. 2012
6. *A New Convex Separable Approximation based on Two-point Diagonal Quadratic Approximation for Large-scale Structural Design Optimization*, 9th World Congress on Structural and Multidisciplinary Optimization, Shizuoka, Japan, 13-17 Jun. 2011
7. *Dual Optimization Approach based on Two-point Diagonal Quadratic Approximation*, The Korean Society of Mechanical Engineer 2010 Fall Conference Korean, Jeju, South Korea, 03-05 Nov. 2010
8. *Optimization for Optical Performances of LCD/BLU Using Pseudo Sensitivity*, The Korean Society of Mechanical Engineer 2009 Fall Conference Korean, Pyeongchang, South Korea, 04-06 Nov. 2009

Teaching Experiences

- Teaching Assistant, ESI6346 Decision making under uncertainty, Spring, 2019
- Teaching Assistant, ESI6552 Systems architecture, Spring, 2019

Professional Activities

Reviewer

- Annals of Mathematics and Artificial Intelligence
- International Journal of Bioinformatics Research and Applications
- SN Operations Research Forum
- Journal of Global Optimization
- Journal of Optimization Theory and Applications

Professional Development Activities

- Participant, *INFORMS Doctorate Student Colloquium*, Phoenix, Arizona, November 2-3, 2018

Services

- Student Council Member, *Korean-American Scientists and Engineers Association Gainesville Florida Chapter*, 2018-present

Courses Taken

- Applied Probability Methods in Engineering, ESI6325
- Linear Programming & Network Optimization, ESI6417
- Stochastic Modelling and Analysis, ESI6546
- Machine Learning for Time Series, EEE6504
- Introduction to Data Analytics, EIN6905
- Fundamentals of Methematical Programming, ESI6420
- Global Optimization, ESI6492
- Numerical Linear Algebra, MAD6406
- Fundamentals of Machine Learning, EEL5840
- Statistical Methods in Research I, STA6166

Certification

- Machine Learning, Stanford University, Coursera, *see certificate*
- Financial Market, Yale University, Coursera, *see certificate*

Computer Skills

- Programming Languages: C/C++(Professional), Python(Professional), MATLAB(Experienced), Java(Experienced), R(Experienced), FORTRAN(Experienced)
- Others: Tensorflow, Pytorch, Theano, Scikit-learn, SQL, Gams, git, LaTeX

References

Panos M. Pardalos
Distinguished Professor, Industrial and systems engineering, University of Florida *pardalos@ise.ufl.edu*

Maciej Rysz
Assistant Professor, Information Systems & Analytics, Farmer school of business, Miami University *ryszmw@miamioh.edu*