MADHURI NAGARE

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Research Interest

Image Processing, Inverse Problems, Machine Learning, AI in Healthcare

Education

Ongoing	Ph.D. in Electronics and Computer Engineering Purdue University, West Lafayette, Indiana Supervisor: Prof. Charles A. Bouman GPA: 3.90/ 4
June 2015	Master of Technology in Geoinformatics and Natural Resources Indian Institute of Technology Bombay (IITB), India CGPA: 9.86/10, Department **rank** 1
June 2013	Bachelor of Technology in Electronics and Telecommunication College of Engineering, Pune (COEP), India CGPA: 9.44/10, Department **rank** 1

Publications

- **M. Nagare**, R. Melnyk, O. Rahman, K. D. Sauer, and C. A. Bouman, "A bias-reducing loss function for CT image denoising," in *2021 IEEE International Conference on Acoustics, Speech and Signal Processing*. IEEE, 2021
- **M. Nagare**, E. Kaneko, M. Toda, H. Aoki, and M. Tsukada, "Cloud shadow removal based on cloud transmittance estimation," in *Geoscience and Remote Sensing Symposium (IGARSS), 2018 IEEE International*. IEEE, 2018, pp. 4031–4034
- **M. Nagare**, H. Aoki, and E. Kaneko, "A unified method of cloud detection and removal robust to spectral variability," in *Geoscience and Remote Sensing Symposium (IGARSS), 2017 IEEE International*. IEEE, 2017, pp. 5418–5421
- P. P. Shingare, **M. M. Nagare**, and C. P. Joshi, "Improved active contour model for satellite images," in *Image Information Processing (ICIIP), 2013 IEEE Second International Conference on*. IEEE, 2013, pp. 499–504

Patents

Jan. 2018	Image Processing Device, Image Processing Method and Storage Medium (Cloud Removal) **Madhuri Nagare**, *Eiji Kaneko, Masato Toda, Masato Tsukada* Patent Number WO2019150453A1, Published Aug. 2019
Sept. 2017	Image Processing Device, Image Processing Method and Storage Medium (Cloud Shadow Removal) **Madhuri Nagare**, *Hirofumi Aoki, Kazutoshi Sagi* Patent Number WO2019049324A1, Published Mar. 2019
Dec. 2016	Image Processing Device, Image Processing Method and Storage Medium (Cloud Removal) **Madhuri Nagare**, *Hirofumi Aoki, Eiji Kaneko* Patent Number WO2018116367A1, Published June. 2018

Internships

May 2019- Aug. 2019	**Ph.D. Intern** **GE Healthcare, Waukesha, USA**
Project	**To enhance quality of low dose CT images**
Results	• Implemented deep learning based methods for the quality enhancement of CT scans • Proposed a robust approach to get MBIR (model-based iterative reconstruction) quality CT images from FBPs (Filtered back-projections) by adding noise to the training data set • Achieved on an average 1.5 dB gain in the peak signal-to-noise ratio

Scholastic Achievements

- Received the **Institute Silver Medal** for securing the departmental rank 1 in the master's batch of 2015 at the Centre of Studies in Resources Engineering (CSRE), IITB
- Received the **Institute Gold Medal** for securing the departmental rank 1 in the bachelor's batch of 2013 at the Department of Electronics and Telecommunication Engineering, COEP
- Secured **Rank 4** in the 2009 Maharashtra Health and Technical Common Entrance Test among 2,16,725 candidates
- Secured **Rank 2** in the 2009 Maharashtra Higher Secondary School Certificate Examination, Pune division

Academic Research

Nov. 2018- Aug. 2020	**Quality Enhancement of CT images** Mentor: Prof. Charles A. Bouman (Purdue University, USA)
Goal	To enhance contrast of CT images
Approach & Results	• Developed and tuned a technique to enhance contrast of CT images • Accomplished the reconstruction of high quality CT images **2.5 times faster** • The technique has been accepted by our industrial partners for the product development
July 2014- June 2015	**Decision Tree Classifiers (DTC) for Satellite Images (Master's Thesis)** Mentor: Prof. B. Krishna Mohan (IITB, India)
Goal	To develop a decision tree classifier which is more flexible and accurate than existing DTCs
Approach & Results	• Proposed a DTC to extract **nonlinear** class boundaries in a feature space by utilizing different classifiers and features at distinct nodes of the tree • Employed a **genetic algorithm** (GA) to determine an appropriate design for the DTC • Built a C library which is used by the MATLAB script of GA to train and to test the DTC • Achieved higher accuracy for land use classification than the conventional CART (Classification And Regression Trees) algorithm
July 2012- June 2013	**Improved Active Contour Model (ACM) for Edge Detection in Satellite Images (Bachelor's Thesis)** Funded by Indian Space Research Organization (ISRO) Mentor: Prof. Pratibha Shingare (COEP, India)
Goal	To devise an algorithm for detecting edges in satellite images efficiently
Approach & Results	• Enhanced the conventional gradient vector flow ACM to detect weak edges in satellite images by amplifying the external energy with an additive gain factor • Devised pre- and post-processing techniques for reducing the ACM's sensitivity to initialization, noise, and the number of objects in an input image • Implemented the method in MATLAB and simulated in Xilinx ISE for an FPGA realization • Detected edges **1.6** times faster as compared to conventional techniques

Industrial Experience

Oct. 2015- Aug. 2018	**Assistant Researcher** **NEC Corporation, Tokyo, Japan**
Project 1	**To design a cloud removal algorithm for the atmospheric correction module of multispectral images**
Approach & Results	• Developed a technique to remove thin clouds from an image based on a radiometric transfer model and a spectral **unmixing** technique while accommodating for **variability** in the cloud **spectrum** • Proposed a clustering method based on spatial - spectral properties of a cloud to identify its variants • Achieved **22%** higher accuracy than the state-of-the-art method for cloud removal • Verified the performance over diverse geographical locations and land covers to ensure robustness
Project 2	**To enhance cloud removal algorithm for cloud shadow removal**
Approach & Results	• Extended the cloud removal technique to include cloud shadow removal • Proposed a method to derive attenuation factors of direct solar irradiance, a key component required to be estimated for cloud shadow removal • Derived the factors by employing cloud transmittance values extracted during cloud removal • Improved accuracy of the removal by **5%** as compared to the existing de-shadowing method

Technical Skills

Programming Languages:	C, MATLAB, PYTHON, KERAS (deep learning API)
Key Courses:	Computer Vision, Model Based Image Processing, Topics in Machine Learning, Digital Image Processing, Digital Signal Processing, Signals and Systems, Advanced Satellite Image Processing, Optimization Methods for Systems and Control, Random Signals and Stochastic Processes, Electromagnetic Waves
Languages:	Marathi (Native), English (Fluent), Hindi (Fluent), Japanese (Basic)

Leadership

Aug. 2019- Dec. 2019	**Treasurer	Indian Graduate Students at Purdue, Purdue University** • Secured funding from the Student Organization Grant Allocation Board for Diwali celebrations, one of the biggest cultural events on campus • Coordinated with a core team of 6 members to successfully organize the event for 800 students
Nov 2016- May 2017	**Group leader	Machine Learning Reading Group, NEC Corporation** • Took initiative to form a group of colleagues interested in learning concepts of machine learning • Coordinated readings and discussions of a book on machine learning by Kevin P. Murphy
June 2014- June 2015	**Executive Member	Graduate Academic Council, IITB** • Led a team of 15 departmental representatives to execute the institute-wide orientation for 1300+ graduate freshmen
July 2014- June 2015	**Student Coordinator	Resources Engineering Association (REA), CSRE, IITB** • Led a council of 15 members to arrange departmental activities such as technical workshops, improving departmental library, raising funds for REA • Managed budgets for the departmental events
July 2013- June 2014	**Graduate Cultural Coordinator	Graduate Cultural Council, IITB** • Coordinated with 10 members to organize a cultural fest for 3500+ students • Publicized and managed the dance genre which witnessed 100% y-o-y increase in participation

Teaching Experience

Fall 2018	**Teaching Assistant** for Probabilistic Methods at Purdue University • Assisted a class of 80 students in understanding the concepts of probability, random variables and processes along with their Python implementation
Fall 2014	**Teaching Assistant** for Satellite Image Processing at IITB • Mentored a batch of 27 students for the coursework and lab • Conducted MATLAB training sessions for the batch

Talks

Topic	**Research on satellite image processing at NEC Corporation**
July 2018	Signal Processing Laboratory LTS4, École Polytechnique Fédérale de Lausanne (EPFL) Audience: Prof. Pascal Frossard and graduate students
July 2017	Department of Geographical Sciences, University of Maryland, College Park Audience: Prof. Dubayah Ralph, Prof. Skakun Sergii, Prof. Franch Belen
Topic	**How to to prepare for competitive entrance exams**
2009	At various schools and coaching centers in the Pune district

Extracurricular & Volunteering

2020	Lead a group of volunteers to explain programming basics to 5^{th}-6^{th} grade students
2020	Mentored a group of high school girls for "Introduce a Girl to Engineering" Day
2019	Volunteered for MathCounts 2019, 2020
2018	Volunteered actively for the Handson Tokyo organization
2014	Assisted in the organization of Geomatrix'14: National Conference of CSRE and REA
2012	Participated in Guinness World Record activity of "Most people solving Rubik's Cube"
2009	Participated in NSS (National Service Scheme) activities in India like plantation, village survey
2005	Earned 'Certificate A' of NCC (National Cadet Corps), India and attended a training camp in Pune

Community Involvement

- Reviewer for IEEE International Conference on Image Processing, Journal of the Indian Society of Remote Sensing
- Active member of IEEE Eta Kappa Nu (HKN)

References

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