UNIVERSITAS GADJAH MADA

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Mathematics Department

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STAFF HANDBOOK

Name	Zenith Purisha		
Position	Applied Mathematics		
Academic Career		Institution	Year
	Initial Academic Appointment	Universitas Gadjah Mada	2011
	Post Doctoral	-	-
	Doctoral Degree	University of Helsinki	2018
	Master Degree	Universitas Gadjah Mada	2011
	Undergraduate Degree	Universitas Gadjah Mada	2008
Employment	Position	Employer	Period
	Tenaga Pengajar	Universitas Gadjah Mada	2011 - present
	Instructor		
	Assistant Professor		
	Associate Professor		
	Full Professor		

Research and development projects over the last 5 years	1. *Sparse X-ray tomography problem is the main focus of my research. A new algorithm and some new implementations to get good reconstruction from the data has been done. Real data produced by CT/µCT machine are tested. State-of-art and modern methods, e.g Barzilai Borwein, Chambolle-Pock & Shearlet for studying bone morphology are implemented. The purpose is to classify the quality of the bone whether it is healthy or osteoarthritic. The samples were harvested from patients going to total knee replacement surgery. The shearlet-based methods using automatic regularization parameter choice work quite well, it outperforms than FDK reconstruction for sparser projection images.* *Collaborators :* *Sakari Karhula - Juuso Ketola - Simo Saarakkala - Miika T. Nieminen : Department of Medical Technology, Faculty of Medicine, Department of Radiology, University of Oulu and Oulu University Hospital.* *Juho Rimpeläinen - Samuli Siltanen : Department of Mathematics and Statistics, University of Helsinki* 2. *Another research is to reconstruct a two-dimensional sparse-data tomographic problem in which the target is assumed to be a homogeneous object bounded by a smooth curve. A Non Uniform Rational Basis Splines (NURBS) curve is used as computational representation of the boundary. This approach conveniently provides the result in a format readily compatible with computer-aided design (CAD) software. However, the linear tomography task becomes a nonlinear inverse problem due to the NURBS-based parameterization. Therefore, Bayesian inversion with Markov chain Monte Carlo (MCMC) sampling is used for calculating an estimate of the NURBS control points. The reconstruction method is tested with both simulated data and measured X-ray projection data.* *Collaborators : Heikki Haario – Lappeenranta University of Technology* *Aki Kallonen – Department of Physics, University of Helsinki* *Marko Laine - Finnish Meteorological Intitute, Finland* *Esa Niemi - Samuli Siltanen - University of Helsinki* 3. *Automatic parameter choice for sparse regularization in X-ray tomography using shearlet-based method.*

	Collaborators : *Juho Rimpeläinen, Tatiana Bubba, Samuli Siltanen – University of Helsinki.* *Maximilian März - Technische Universität Berlin* *4. Tomographic image reconstruction with the Bayesian approach. The goal is to produce an accurate reconstruction of an object using various projection angles together with the discretization of the radon transform. In this work we consider a more consistent probabilistic approach to this topic, namely, methods utilizing basic principles of the Bayes' theorem, which has been considered the natural choice for a probabilistic framework when dealing with unknown quantities and partial information.* *Collaborator : Marcelo Hartmann – University of Helsinki* *5. A Study of Bayesian Overconfidence* *Collaborators:* *Martin Burger – University of Münster* *Tapio Helin – University of Helsinki* *Felix Lucka - University College London*
Industry collaborations over the last 5 years	Project title : Partners:

Patents and proprietary rights	Title	Year

Important publications over the last 5 years	Selected recent publications form a total of approx.: 6
	Purisha, Zenith, and Samuli Siltanen. "Tomographic Inversion using NURBS and MCMC." *Forging Connections between Computational Mathematics and Computational Geometry*. Springer, Cham, 2016. 153-166.
	Purisha, Zenith, and Samuli Siltanen. "Tomographic Reconstruction of Homogeneous 2D Geometric Models with Unknown Attenuation." *IFIP Conference on System Modeling and Optimization*. Springer Berlin Heidelberg, 2013.
	Haario, H., Kallonen, A., Laine, M., Niemi, E., Purisha, Z., & Siltanen, S. (2016). Shape recovery from sparse tomographic X-ray data. *arXiv preprint arXiv:1605.01285.*

	Zenith Purisha, Sakari Karhula, Juuso Ketola, Juho Rimpeläinen, Miika T. Nieminen, Simo Saarakkala and Samuli Siltanen *Accelerated-scan X-ray microtomography for assessing bone mineral content* (In preparation) Zenith Purisha, Juho Rimpeläinen, Tatiana Bubba, Maximilian März, Samuli Siltanen. *Automatic parameter choice for sparse regularization in X-ray tomography* (In preparation) Zenith Purisha, Marcelo Hartmann. *Tomographic image reconstruction with the Bayesian approach* (In preparation)		
Activities in specialist bodies over the last 5 years *(Membership without a specific role need not be mentioned)*	Organization	Role	Period
	PPI Finlandia ry (Indonesian Student Association in Finland)	Education Division (organizing seminars and workshops about research interest especially from Indonesian students in Finlandia)	2013 - 2015