HEUNA KIM

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EDUCATION

Freie Universität Berlin (FU Berlin), Germany
Ph.D. Mathematics
A Perspective title of Ph.D. Thesis: Congruence testing for point sets in 4-space.
- Thesis summary: The fixed-parameter tractability of the congruence testing problem with a dimension parameter d is a long-standing well-known open problem in computational geometry. This thesis includes a new optimal algorithm in 4-space.

Advisor: Prof. Günter Rote 06/2013 - 06/2016

Korea Advanced Institute of Science and Technology (KAIST), South Korea
M.S. Computer Science
Master Thesis: On the Number of Edges of a Fan-Crossing Free Graph
Advisor: Prof. Otfried Cheong 02/2011 - 02/2013

Pohang University of Science and Technology (POSTECH), South Korea
B.S. Mathematics, Minor in Physics 03/2004 - 02/2008

Jeju Science High School for Gifted Students 03/2002 - 02/2004

RELEVANT COURSE-WORK

Statistics: Mathematical Statistics, Applied Statistics(SAS).
Optimization: Nonlinear Programming, Operation Research.
Machine learning: Artificial Intelligence (R).
Large Scale: Internet System Technology (Distributed Computing, Hadoop).
Motion Planning: Lie Algebra, Dynamics, Mathematical Methods for Physics (Matlab).
Functional Programming: Programming Language (SML,Haskell).

HONORS AND AWARDS

Scholarship from **Methods for Discrete Structures**/
Membership of **Berlin Mathematical School** 2013-present
Best Poster Award for Master Thesis 2013
National Research Scholarship by the Korea Student Aid Foundation 2011-2013
Honorable Scholarship from the President of Korea 2004-2007
Honorable Scholarship from Korea Foundation for Advanced Studies 2006-2007
Winner of Security Competition in POSTECH-KAIST Science Festival 2005
Silver Medal from National Collegiate Programming Competition 2004
Dean's List (POSTECH) Spring and Fall 2004, Fall 2006, Spring 2007
University Grant (POSTECH) 2004-2008
Scholarship for ESL Course at UC Davis from POSTECH 2004

SKILLS

Programming	C++/C, Java, Python, Sage, Matlab, Maple, R, Octave, SML, Haskell, Coq, SQL, SAS, Hadoop, Tex.
OS	Linux (10 years) , Windows.
Language	English: IBT 105/120, Nov. 2012, German: C1, Korean: Native

PAPERS AND WORKSHOPS

(Authors are in the alphabetic order.)

Michael G. Dobbins, **Heuna Kim**, Luis Montejano, and Edgardo Roldán-Pensado, **Shadows of a Closed Curve**, International Mathematics Research Notices, pp. 1073-7928, 2018.

– Topological methods were used to show impossibility of embedding a closed curve in any d-dimension with restrictions on its orthogonal projections.

Heuna Kim, Günter Rote, **Congruence Testing for Point Sets in 4-space,** 32nd International Symposium on Computational Geometry (SoCG 2016).

– Coxeter Classification, Grassmannian, Plücker embedding, and Hopf fibrations are used to develop a 4-dimensional optimal congruence-testing algorithm. This result contributes to one of the long-standing open problems in computational geometry.

Prosenjit Bose, Jean-Lou De Carufel, Michael G. Dobbins, **Heuna Kim**, and Giovanni Viglietta, **The Shadows of a Cycle Cannot All Be Paths,** In Proceedings of the 27th Canadian Conference on Computational Geometry (CCCG'15), pp. 70-75, 2015

– A 3-dimensional geometric puzzle was solved.

Heuna Kim, Wolfgang Mulzer, and Eunjin Oh. **The Number of Combinatorially Different Convex Hulls of Points in Lines,** In Abstracts of the 31st European Workshop on Computational Geometry (EuroCG), 2015.

– The trapezoidal zone theorem for a line arrangement is extended by a bit-encoding technique. This is used to show asymptotic tight bounds of a geometric optimization problem. This result is related to imprecise data.

Heuna Kim, Till Miltzow. **Packing Segments in a Simple Polygon is APX-hard,** In Abstracts of the 31st European Workshop on Computational Geometry (EuroCG), 2015.

– A collection of complexity results (NP-hard, APX-hard, and an approximation algorithm) related to one of the fundamental packing problems is presented.

Michael Gene Dobbins and **Heuna Kim**. **Packing Segments in a Convex 3-Polytope is NP-hard,** In Abstracts of the 30th European Workshop on Computational Geometry (EuroCG), 2014.

– A construction of generic planes in a 3-space is used to show NP-hardness of one of the important maximum-packing problem.

Otfried Cheong, Sariel Har-Peled, **Heuna Kim**, and Hyo-Sil Kim. **On the number of edges of a fan-crossing free graph**, Algorithmica, 73 (2015) 673–695. (On invitation, special issue on ISAAC 2013.)
Otfried Cheong, Sariel Har-Peled, **Heuna Kim**, and Hyo-Sil Kim. **On the number of edges of a fan-crossing free graph**, In Proceedings of the 24th International Symposium on Algorithms and Computation (ISAAC), 2013.
Otfried Cheong, Sariel Har-Peled, **Heuna Kim**, and Hyo-Sil Kim. **On the number of edges of a fan-crossing free graph**, 6th Annual Meeting of the Asian Association for Algorithms and Computation (AAAC), 2013.

– Combinatorial arguments are used to give the tight bound for a graph-embedding problem.

Raghav Goyal, Samira Ebrahimi Kahou, Vincent Michalski, Joanna Materzynska, Susanne Westphal, **Heuna Kim**, Valentin Haenel, Ingo Fruend, Peter Yianilos, Moritz Mueller-Freitag, Florian Hoppe, Christian Thurau, Ingo Box, and Roland Memisevic, **The" Something Something" Video Database for Learning and Evaluating Visual Common Sense**, ICCV, Vol. 1, No.2, p.3, 2017.

- To capture the common sense in video data, an open video data set for deep learning was created and multiple combinations of RNN and CNN models were applied to analyze the dataset.

Hyejin Park, **Heun A Kim**, Seung-ho Yang, and Jaewook Lee, **Transductive Bayesian regression via manifold learning of prior data structure**, Expert Systems with Applications, Vol.39, No.16, pp.12557-12563, 2012.

- The inductive process for a dimension reduction method called Local Tangent Space Alignment(LTSA) was developed for a robust Bayesian regression.

TEACHING EXPERIENCE

Design and Analysis of Algorithm, KAIST (teaching assistant) Spring 2012

Analysis and Applications of Network Science, KAIST (teaching assistant) Fall 2011

Sommeruniversität: Experiencing Theoretical Computer Science with Origami, FU Berlin (instructor) Summer 2014

RESEARCH EXPERIENCE

Arbeitsgruppe Theoretische Informatik, FU Berlin June 2013 - present
Advisor: Günter Rote
- Designed an efficient congruence testing algorithm in the high-dimensional space.

LIGM, UPEM May 2015
Advisor: Xavier Goaoc
- Researched about contractability of a special line space using line geometry.

Instituto de Matemáticas, UNAM April 2015
Advisor: Edgardo Roldan Pensádo, Luis Montejano Peimbert
- Learned about topological methods including persistent cohomology.

VEGAS group in INRIA Nancy April 2013
Advisor: Xavier Goaoc, Jean-Sébastien Sereni
- Surveyed the structure of minimal simplicial complexes with respect to the bounded VC dimension. Related to Sauer lemma.

Discrete Geometry Lab., KAIST February 2011 - April 2013
Advisor: Otfried Cheong
- Researched the properties of fan-crossing free graphs and ε-area-good objects
- Studied about approximation algorithms, discrete geometry and geometric data structures.

Machine Learning Lab., POSTECH Spring 2009
Advisor: Seungjin Choi
- Studied about graphical models, probabilistic relational models and various machine learning techniques including clustering, statistical learning theory, etc.

Information and Database System Lab., POSTECH *(undergraduate)* Spring 2007
Advisor: Seungwon Hwang
- Researched the problem finding a convex-hull (or a sky-line query) for uncertain databases.

Informatics Lab., POSTECH *(undergraduate)* Summer and Fall 2006
Advisor: Jae Wook Lee
- Surveyed manifold learning and researched for improving the robustness of a manifold-based regression with white noises.

ATTENDED WORKSHOP AND PROGRAMS

Winter School on Combinatorial and Algorithmic Aspects of Convexity	January 2015	Paris, France
Oberwolfach Workshop on Discrete Geometry	September 2014	Oberwolfach, Germany
Fixed Parameter Tractability Summer School	August 2014	Bedlewo, Poland
Korean Workshop on Computational Geometry	June 2014	Hiddensee, Germany
MADALGO Summer School on Algorithms for Modern Parallel and Distributed Models	August 2012	Aarhus, Denmark

RESEARCH TALKS AND POSTER

40 min.	Oct. 30. 2015	MDS Status Workshop
60 min	Jan. 5. 2015	MDS Monday Colloquium
35 min.	Oct. 16. 2014	MDS Status Workshop
40 min	May. 18. 2015	LIGM Seminar in UPEM
60 min.	Apr. 21. 2015	Seminario Pregunton in UNAM Juriquilla
30 min.	Nov. 8. 2014	Kolloquium ber Kombinatorik, Ilmenau
20 min.	Mar. 17. 2015	EuroCG at Ljubliana
15 min.	Mar. 5. 2014	EuroCG at Ein-Gedi
30 min.	Dec. 01. 2015, Oct. 08. 2015, Jun. 04. 2015, Jan. 27. 2015, Jun. 5. 2014, Feb. 27. 2014, Feb. 6. 2014, Nov. 26. 2013, Mar. 26. 2013	Mittagsseminar at Theoretical Computer Science Group, FU Berlin
20 min.	Dec. 16. 2013	ISAAC, HKU Hong Kong
75 min.	Dec. 11. 2013	Lie Groups and Lie Algebra Seminar, FU Berlin
Poster	Oct. 8-9. 2013	Delaunay Geometry: Polytopes, Triangulations and Spheres Workshop, FU-Berlin
45 min.	Apr. 18. 2013	VEGAS Seminar at INRIA Nancy - Grand Est Research Center, Loria Lab.
40 min.	Apr. 10. 2013	Mittagsseminar at Algorithms and Data Structures Group, University of Bayreuth
30 min.	Mar. 28. 2013	Mittagsseminar at Theory of Combinatorial Algorithms Group, ETH
Poster	Dec. 21. 2012	Master Candidate Workshop, KAIST
50 min.	Nov. 11. 2012, Sep. 15. 2012, Apr. 19. 2012	Discrete and Computational Geometry Lab. Seminar, KAIST
Poster	Aug. 21-23. 2012	MADALGO Summer School on Algorithms for Modern Parallel and Distributed Models, Aarhus University