CG Week, June 17–21, 2019

Location key:
UPlace A = University Place, Multnomah Falls + Elowah Falls Ballroom
UPlace B = University Place, Wahkeena Falls Ballroom
UPlace Lobby = University Place, Columbia Falls Ballroom lobby
Maseeh = Maseeh College of Engineering and Computer Science, classrooms
Maseeh Atrium = Maseeh College, central atrium
Crystal = Crystal Ballroom

*Student talks are asterisked, student speakers underlined.

Monday, June 17, 2019

earlier	Excursions	Off-site
6:00–8:00pm	Welcome reception	UPlace A + B

Tuesday, June 18, 2019

9:00–9:10	Welcome	UPlace A
9:10–9:40	SoCG Best Paper, Session TUE-1 (chair: Yusu Wang & Gill Barequet)	UPlace A

Almost Tight Lower Bounds for Hard Cutting Problems in Embedded Graphs

V. Cohen-Addad, É. Colin de Verdière, D. Marx and A. de Mesmay

9:40–10:20	Fast forward: Workshops, YRF Part 1	UPlace A
10:20–10:50	Coffee break	UPlace Lobby
10:50–11:50	SoCG Session TUE-2	UPlace A + B

Session TUE-2A: Data Structures I, UPlace A (chair: Dan Halperin)

10:50 **Dynamic Planar Point Location in External Memory**   J. I. Munro and Y. Nekrich

11:10 **A Divide-and-Conquer Algorithm for Two-Point L_1 Shortest Path Queries in Polygonal Domains**   Haitao Wang

11:30 **Maintaining the Union of Unit Discs under Insertions with Near-Optimal Overhead**   Pankaj K. Agarwal, Ravid Cohen, Dan Halperin and Wolfgang Mulzer

Session TUE-2B: Persistent Homology I, UPlace B (chair: Erin Chambers)

10:50 *__DTM-based Filtrations__   H. Anai,   F. Chazal,   M. Glisse,   Y. Ike,   H. Inakoshi, R. Tinarrage and Y. Umeda

11:10 **Topological Data Analysis in Information Space**   Herbert Edelsbrunner, Ziga Virk, Hubert Wagner

11:30 **On the Metric Distortion of Embedding Persistence Diagrams into separable Hilbert spaces**   M. Carrière and U. Bauer

11:50–12:00	Break	UPlace Lobby
12:00–1:00	SoCG Session TUE-3	UPlace A + B

SESSION TUE-3A: COMBINATORIAL GEOMETRY I, UPLACE A (chair: Joseph Mitchell)

12:00 ***On the Complexity of the k-Level in Arrangements of Pseudoplanes** M. Sharir and <u>C. Ziv</u>

12:20 ***On grids in point-line arrangements in the plane** <u>M. Mirzaei</u> and A. Suk

12:40 **The Crossing Tverberg Theorem** R. Fulek and B. Gärtner and A. Kupavskii and P. Valtr and U. Wagner

SESSION TUE-3B: ε-NETS AND VC DIMENSION, UPLACE B (chair: Steve Oudot)

12:00 **On weak ε-nets and the Radon number** S. Moran and A. Yehudayoff

12:20 **Distribution-Sensitive Bounds on Relative Approximations of Geometric Ranges** Y. Tao and Y. Wang

12:40 ***Journey to the Center of the Point Set** S. Har-Peled and <u>M. Jones</u>

1:00–2:30	Catered lunch, sponsored by Mentor Graphics	Maseeh Atrium
2:30–4:00	Workshops + YRF	Maseeh

YOUNG RESEARCHERS FORUM, MASEEH EB 92 (chair: Steve Oudot)

2:30 **Ellipsoidal Voronoi Diagrams** Ahmed Abdelkader and David Mount

2:50 **On tree-like abstract Voronoi diagrams in expected linear time** Kolja Junginger and Evanthia Papadopoulou

3:10 **On Mergable Coresets for Polytope Distance** Benwei Shi, Aditya Bhaskara, Waiming Tai and Jeff Phillips

3:30 **Art Gallery Problem for Indoor Localization** Haotian Wang, Jie Gao, Niranjini Rajagopal, Anthony Rowe and Bruno Sinopoli

8TH ANNUAL MINISYMPOSIUM ON COMPUTATIONAL TOPOLOGY, MASEEH EB 103

2:30 **Exact Topological Inference of the Resting-State Brain Network in Twins** Moo K. Chung

3:30 **Metric learning for persistence-based summaries and application to graph classification** Yusu Wang

WORKSHOP ON OPEN PROBLEMS AND HARD INSTANCE CHALLENGES, MASEEH EB 102

2:30 **Introduction: Overview, summary of background on the The Open Problems Project (TOPP), updates (TOPP 2.0), and the role of open problems in driving research in CG/CT**

Contributed open problems

4:00–4:30	Coffee/snack break	Maseeh Atrium
4:30–6:30	Workshops + YRF (continued)	Maseeh

YOUNG RESEARCHERS FORUM, MASEEH EB 92 (chair: Radoslav Fulek)

4:30 **Trajectory Visibility in a Simple Polygon**   Patrick Eades, Ivor van der Hoog, Frank Staals and Maarten Löffler

4:50 **Computing feasible trajectories for an articulated probe in three dimensions**   Ovidiu Daescu and Ka Yaw Teo

5:10 **New Applications of Nearest-Neighbor Chains**   Nil Mamano, Alon Efrat, David Eppstein, Daniel Frishberg, Michael Goodrich, Stephen Kobourov, Pedro Matias and Valentin Polishchuk

5:30 **Active Learning a Convex Body in Low Dimensions**   Sariel Har-Peled, Mitchell Jones and Saladi Rahul

8TH ANNUAL MINISYMPOSIUM ON COMPUTATIONAL TOPOLOGY, MASEEH EB 103

4:30 **Topological Techniques for Characterizing Patterns Induced by Ion Bombardment**   Rachel Neville

5:00 **Topology-Preserving Deep Image Segmentation for Thin Biomedical Structures**   Chao Chen

5:30 **Sketching and Clustering Metric Measure Spaces**   Kritika Singhal

6:00 **Generalized Persistence Algorithm for Decomposing Multi-parameter Persistence Modules**   Tamal Dey

WORKSHOP ON OPEN PROBLEMS AND HARD INSTANCE CHALLENGES, MASEEH EB 102

4:30 **Hard Instances Challenge overview, and presentation of prizes**

Presentation by winner(s) of the challenge

Wrap-up and summary; benchmarks, contest repositories, Hard Instances Project (HIP); future directions discussion

Wednesday, June 19, 2019

9:00–10:00	SoCG Session WED-4	UPlace A + B

Session WED-4A: Smallest Enclosing, UPlace A (chair: Subhash Suri)

9:00   *Probabilistic Smallest Enclosing Ball in High Dimensions via Subgradient Sampling   A. Krivošija and A. Munteanu

9:20   Smallest k-Enclosing Rectangle Revisited   T. M. Chan and S. Har-Peled

9:40   Computing Shapley Values in the Plane   S. Cabello and T. M. Chan

Session WED-4B: Persistent Homology II, UPlace B (chair: Bettina Speckmann)

9:00   Exact computation of the matching distance on 2-parameter persistence modules   Michael Kerber, Michael Lesnick and Steve Oudot

9:20   Chunk Reduction for Multi-Parameter Persistent Homology   U. Fugacci and M. Kerber

9:40   *Computing Persistent Homology of Flag Complexes via Strong Collapses   J-D. Boissonnat and S. Pritam

10:00–10:30	Coffee break	UPlace Lobby
10:30–11:30	SoCG Session WED-5	UPlace A + B

Session WED-5A: Combinatorial Geometry II, UPlace A (chair: Pankaj Agarwal)

10:30   *Ham-Sandwich cuts and center transversals in subspaces   Patrick Schnider

10:50   On the chromatic number of disjointness graphs of curves   János Pach and István Tomon

11:10   Semi-algebraic colorings of complete graphs   J. Fox, J. Pach, and A. Suk

Session WED-5B: Optimization and Approximation, UPlace B (chair: Jeff Phillips)

10:30   Packing Disks into Disks with Optimal Worst-Case Density   S. P. Fekete and P. Keldenich and C. Scheffer

10:50   *Preconditioning for the Geometric Transportation Problem   A. B. Khesin, A. Nikolov, and D. Paramonov

11:10   *Algorithms for Metric Learning via Contrastive Embeddings   D. Ihara, N. Mohammadi and A. Sidiropoulos

11:30–11:40	Break	UPlace Lobby
11:40–12:40	Invited talk, Sanjoy Dasgupta (chair: Yusu Wang)	UPlace A

A Geometric Data Structure from Neuroscience
Sanjoy Dasgupta, UC San Diego

12:40–2:30	Lunch on your own	Off-site
2:30–3:30	SoCG Session WED-6	UPlace A + B

SESSION WED-6A: GRAPH DRAWING I, UPLACE A (chair: Matias Korman)

2:30 ***Efficient Algorithms for Ortho-Radial Graph Drawing** B. Niedermann, I. Rutter, and M. Wolf

2:50 ***Bounded degree conjecture holds precisely for c-crossing-critical graphs with $c \le 12$** D. Bokal, Z. Dvořák, P. Hliněný, J. Leaños, B. Mohar, T. Wiedera

3:10 **$\mathbb{Z}_2$-Genus of Graphs and Minimum Rank of Partial Symmetric Matrices** R. Fulek and J. Kynčl

SESSION WED-6B: MATCHING AND PARTITIONING, UPLACE B (chair: Monique Teillaud)

2:30 **A Weighted Approach to the Maximum Cardinality Bipartite Matching Problem with Applications in Geometric Settings** N. Lahn and S. Raghvendra

2:50 **An Efficient Algorithm for Generalized Polynomial Partitioning and Its Applications** P. K. Agarwal, B. Aronov, E. Ezra, and J. Zahl

3:10 ***Efficient Algorithms for Geometric Partial Matching** Pankaj K. Agarwal, Hsien-Chih Chang, Allen Xiao

3:30–4:00	Coffee/snack break	UPlace Lobby
4:00–5:00	SoCG Session 7	UPlace A + B

SESSION WED-7A: TOPOLOGY, UPLACE A (chair: Raimund Seidel)

4:00 **Topologically Trivial Closed Walks in Directed Surface Graphs** Jeff Erickson and Yipu Wang

4:20 ***3-Manifold Triangulations with Small Treewidth** K. Huszár and J. Spreer

4:40 **When Convexity Helps Collapsing Complexes** D. Attali, A. Lieutier, and D. Salinas

SESSION WED-7B: ALGORITHM COMPLEXITY, UPLACE B (chair: Gill Barequet)

4:00 ***The One-Way Communication Complexity of Dynamic Time Warping Distance** V. Braverman, M. Charikar, W. Kuszmaul, D. P. Woodruff, and L. F. Yang

4:20 **Upward Book Embeddings of st-Graphs** C. Binucci, G. Da Lozzo, E. Di Giacomo, W. Didimo, T. Mchedlidze, M. Patrignani

5:00–6:00	Discussion forum	UPlace A
7:00–?	Banquet	Crystal

Thursday, June 20, 2019

9:00–10:00	SoCG Session THU-8	UPlace A + B

SESSION THU-8A: CONTACT AND SURFACE GRAPHS, UPLACE A (chair: Christiane Schmidt)

9:00   *__Near-optimal Algorithms for Shortest Paths in Weighted Unit-Disk Graphs__
H. Wang, <u>J. Xue</u>

9:20   __Morphing Contact Representations of Graphs__   Patrizio Angelini, Steven Chaplick,
Sabine Cornelsen, Giordano Da Lozzo, Vincenzo Roselli

9:40   __Lower Bounds for Electrical Reduction on Surfaces__   Hsien-Chih Chang, Marcos
Cossarini, Jeff Erickson

SESSION THU-8B: FRECHÉT DISTANCE, UPLACE B (chair: Chee Yap)

9:00   __The VC Dimension of Metric Balls under Fréchet and Hausdorff Distances__
A. Driemel, J. M. Phillips, I. Psarros

9:20   *__Walking the Dog Fast in Practice: Algorithm Engineering of the Fréchet
Distance__   K. Bringmann, M. Künnemann and <u>A. Nusser</u>

9:40   *__Polyline Simplification has Cubic Complexity__ K. Bringmann and
<u>B. R. Chaudhury</u>

10:00–10:30	Coffee break	UPlace Lobby
10:30–11:30	SoCG Session THU-9	UPlace A + B

SESSION THU-9A: GEOMETRIC DATA STRUCTURES, UPLACE A (chair: Tamal Dey)

10:30   *__A Spanner for the Day After__   K. Buchin, S. Har-Peled and <u>D. Oláh</u>

10:50   *__Searching for the Closest-pair in a Query Translate__   <u>J. Xue</u>, Y. Li, S. Rahul,
R. Janardan

11:10   *__Preprocessing Ambiguous Imprecise Points__   <u>I. van der Hoog</u>, I. Kostitsyna, M.
Löffler, B. Speckmann

SESSION THU-9B: ROBOTICS AND GEOMETRIC STRUCTURES, UPLACE B (chair: Esther Ezra)

10:30   __General techniques for approximate incidences and their application to the
camera posing problem__   D. Aiger, H. Kaplan, E. Kokiopoulou, M. Sharir, B. Zeisl

10:50   __Rods and Rings: Soft Subdivision Planner for $\mathbb{R}^3 \times S^2$__   C.-H. Hsu, Y.-J. Chiang
and C. Yap

11:10   __Optimal algorithm for geodesic farthest-point Voronoi diagrams__   Luis Barba

11:30–11:40	Break	UPlace Lobby
11:40–11:55	Fast forward: YRF Part 2	UPlace A
11:55–12:45	Multimedia session (chair: Christiane Schmidt)	UPlace A

Fréchet View – A Tool for Exploring Fréchet Distance Algorithms   Peter Schäfer

A manual comparison of convex hull algorithms   Maarten Löffler

Packing Geometric Objects with Optimal Worst-Case Density   A. T. Becker, S. P. Fekete, P. Keldenich, S. Morr, C. Scheffer

Properties of Minimal-Perimeter Polyominoes   G. Barequet and G. Ben-Shachar

12:45–1:30	Box lunch	UPlace Lobby
1:00–2:20	Business meeting	UPlace A
2:30–4:00	Workshops + YRF	Maseeh

YOUNG RESEARCHERS FORUM, MASEEH EB 92 (chair: Erin Chambers)

2:30   **Skeletonisation Algorithms for Unorganised Point Clouds with Theoretical Guarantees**   Philip Smith and Vitaliy Kurlin

2:50   **Jaccard Filtration and stable paths for Mapper**   Nathaniel Saul, Bala Krishnamoorthy and Dustin Arendt

3:10   **First Steps Towards Lower-Bounding the Number of Topological Descriptors for Reconstruction**   Samuel Micka and David L. Millman

3:30   **On the Average Time Complexity of the Reduction Algorithm for Persistent Homology**   Hannah Schreiber and Michael Kerber

THE 4TH WORKSHOP ON GEOMETRY AND MACHINE LEARNING, MASEEH EB 103

2:30   **Tutorial: A Primer on the Geometry in Machine Learning**   Jeff Phillips (University of Utah)

3:00   **Greedy Is Good, But Needs Randomization**   Hu Ding (University of Science and Technology of China & Michigan State University)

3:20   **Condensation for the Approximate Nearest-Neighbor Rule**   Alejandro Flores-Velazco (University of Maryland)

3:40   **Relative Error RKHS Embeddings for Gaussian Kernels**   Wai Ming Tai (University of Utah)

ALGEBRAIC METHODS IN DISCRETE AND COMPUTATIONAL GEOMETRY, MASEEH EB 102

2:30   **Algebraic techniques in geometry: State of (some of) the art**   Micha Sharir

3:30   **Cutting space curves and applications to discrete geometry**   Josh Zahl

4:00–4:30	Coffee/snack break	Maseeh Atrium
4:30–6:00	Workshops + YRF (continued)	Maseeh

YOUNG RESEARCHERS FORUM, MASEEH EB 92 (chair: Donald Sheehy)

4:30 **A Toroidal Maxwell-Cremona-Delaunay Correspondence**   Patrick Lin and Jeff Erickson

4:50 **On Minimal-Perimeter Polyforms**   Gill Barequet and Gil Ben-Shachar

5:10 **A 1/4-Approximation Algorithm for the Maximum Hidden Vertex Set Problem in Simple Polygons**   Pritam Bhattacharya and Carlos Alegria

5:30 **Hardness of Approximation for Geometric Set Cover and Related Problems** Sima Hajiaghaei

THE 4TH WORKSHOP ON GEOMETRY AND MACHINE LEARNING, MASEEH EB 103

4:30 **Invited: Approaches to Robust Artificial Intelligence: Can Geometry Help?** Thomas G. Dietterich (Oregon State University)

5:20 **On the Geometry of Adversarial Examples**   Marc Khoury (UC Berkeley)

5:40 **A Topological Regularizer for Classifiers via Persistent Homology**   Chao Chen (Stony Brook University)

ALGEBRAIC METHODS IN DISCRETE AND COMPUTATIONAL GEOMETRY, MASEEH EB 102

4:30 **Geometric approximation algorithms via the polynomial method**   Timothy Chan

5:30 **On Soft Computational Geometry**   Chee Yap

| 6:00–7:00 | Springer-hosted reception | Maseeh Atrium |

Friday, June 21, 2019

9:00–10:00	SoCG Session FRI-10	UPlace A + B

SESSION FRI-10A: DATA STRUCTURES II, UPLACE A (chair: Yusu Wang)

9:00 **A New Lower Bound for Semigroup Orthogonal Range Searching**   Peyman Afshani

9:20 **Independent Range Sampling, Revisited Again**   Peyman Afshani and Jeff M. Phillips

9:40 **Dynamic Geometric Data Structures via Shallow Cuttings**   T. M. Chan

SESSION FRI-10B: GRAPH DRAWING II, UPLACE B (chair: Evanthia Papadopoulou)

9:00 **Dual Circumference and Collinear Sets**   V. Dujmović and P. Morin

9:20 **Cubic Planar Graphs That Cannot Be Drawn On Few Lines**   David Eppstein

9:40 **Connecting the Dots (with Minimum Crossings)**   Akanksha Agrawal, Grzegorz Guśpiel, Jayakrishnan Madathil, Saket Saurabh, Meirav Zehavi

10:00–10:30	Coffee break	UPlace Lobby
10:30–11:30	SoCG Session FRI-11	UPlace A + B

SESSION FRI-11A: COMPLEXITY, UPLACE A (chair: Kasturi Varadarajan)

10:30   **The Unbearable Hardness of Unknotting**   A. de Mesmay, Y. Rieck, E. Sedgwick, M. Tancer

10:50   **Circumscribing Polygons and Polygonizations for Disjoint Line Segments**   H. A. Akitaya, M. Korman, M. Rudoy, C. D. Tóth, and D. L. Souvaine

11:10   **Counting Polygon Triangulations is Hard**   David Eppstein

SESSION FRI-11B: COMBINATORIAL GEOMETRY III, UPLACE B (chair: Micha Sharir)

10:30   **An Experimental Study of Forbidden Patterns in Geometric Permutations by Combinatorial Lifting**   Goaoc X., Holmsen A., and Nicaud C.

10:50   **A Product Inequality for Extreme Distances**   Adrian Dumitrescu

11:10   **Convex Polygons in Cartesian Products**   J.-L. De Carufel, A. Dumitrescu, W. Meulemans, T. Ophelders, C. Pennarun, C. D. Tóth, and S. Verdonschot

11:30–11:40	Break	UPlace Lobby
11:40–12:40	Invited talk, Bruce Donald (chair: Gill Barequet)	UPlace A

Some Geometric and Computational Challenges Arising in Structural Molecular Biology
Bruce Donald, Duke University

12:40–2:30	Lunch + Birthday celebration for John Hershberger	Maseeh

12:40   **Lunch**   (Maseeh Atrium)

1:15   **Birthday celebration**   (Maseeh EB 102)

2:15   **Birthday cake and coffee**   (Maseeh Atrium)

2:30–4:00	Workshops	Maseeh

8TH ANNUAL MINISYMPOSIUM ON COMPUTATIONAL TOPOLOGY, MASEEH EB 92

2:30   **TDA on Genomics Data**   Laxmi Parida

3:30   **Geodesics in persistence diagram space**   Samir Chowdhury

ALGEBRAIC METHODS IN DISCRETE AND COMPUTATIONAL GEOMETRY, MASEEH EB 102

2:30   **Applications of algebraic geometry and model theory in incidence combinatorics**   Saugata Basu

3:30   **Some things algebra told us about order types**   Xavier Goaoc

4:00–4:30	Coffee/snack break	Maseeh Atrium
4:30–6:00	Workshops (continued)	Maseeh

8TH ANNUAL MINISYMPOSIUM ON COMPUTATIONAL TOPOLOGY, MASEEH EB 92

4:30 **PersLay: A Simple and Versatile Neural Network Layer for Persistence Diagrams** Mathieu Carriere

5:00 **Open Questions and Discussions**

ALGEBRAIC METHODS IN DISCRETE AND COMPUTATIONAL GEOMETRY, MASEEH EB 102

4:30 **Computing the first dimensional path homology for directed graphs** Yusu Wang

5:00 **Ordered graphs and large bi-cliques in intersection graphs of curves** Istvan Tomon

5:30 **Polynomial partitioning: Algorithms and applications** Esther Ezra