

James Abello

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Education

- Computer Science President's Post Doctoral Fellow - University of California, Santa Barbara.
- Ph.D. University of California, San Diego.
Specialization in Combinatorial Algorithms,
Supervised by Professor Stanley Gill Williamson.
- M.S. University of California, Santa Barbara.
Specialization in Operating Systems,
Supervised by Professor John Bruno.

Research Areas

- Current areas of research center on External Memory Algorithms, Data Graph Mining, Relational Learning and Visualization of Massive Data Sets. Typical examples of data we have dealt with include information networks like **The Web, Query co-occurrence, Internet, Wireless Call Detail and Epidemiological data**. Our research has been funded mainly by NSF, DHS, USDA and LLNL.
- Previous research focus included Computational Geometry, Combinatorics and Complexity, Algorithm Animation and some applications in Petroleum Engineering and Biology.

Professional Experience

- **Academic**
 - Computer Science Department, Rutgers University
Director of the MSCS Program and Associate Professor 2015 - present.
 - DIMACS, Rutgers University
Research Professor 2006 - 2015;
 - Computer Science Department, Texas A&M University
Research Associate Professor, 1994-1995;
Director of the Laboratory for Algorithms Design, 1990-1994;
Assistant Professor, 1988-1993;
Supervised 1 Ph.D. Dissertation and 7 Master Theses.

- Computer Science and Mathematics Departments -
University of California, Santa Barbara and San Diego: Visiting
Professor and Lecturer, 1986-1987.
- **Industrial**
 - Senior Research Scientist, Ask.com, 2004 - 2007.
 - Senior Member of Technical Staff, AT&T Labs, and Bell Labs, 1995 -
2002.
- **Administrative**
 - Program Committee Member of the 2016 IEEE International Conference
on Big Data, Dec. 2016.
 - Leader of the Universal Information Graphs Project at DyDAn (A
founded multi million DHS center of excellence at Rutgers University).
Conceived and designed the project. Developed new algorithms for
semi-external data partitioning. Identified, hired and supervised key
personal to build the overall hardware and software
infrastructure. Participated in the overall DyDAn proposal writing.
 - Organizer of the [DyDAn Seminar series](#), 2007.
 - Organizer of DIMACS [Computational and Mathematics Epidemiology
Seminar series](#), 2006-2007.
 - Program Co-Chair (with G. Cormode) of DIMACS [Tutorial on Data
Mining and Epidemiology](#), March 23-24, 2006.
 - Program Chair of the First DIMACS Workshop on [Data Mining and
Epidemiology](#), March 18-19, 2004.
 - Conceived, Designed and made operational a software platform for
Query Relevance Algorithms Research. Interviewed, hired and
supervised the required technical personal, Ask.com, 2004-2006.
 - Member of the Editorial Board of the Journal on Discrete Algorithms,
Elsevier Publishers, 2002-present.
 - Program Chair of the First AT&T Visualization Days, May 30, 2001.
 - Program Co-Chair (with J. Vitter) of the First DIMACS Workshop
on [External Memory Algorithms and Visualization](#), May 20-22, 1998.
 - Co-Editor of the Massive Computing Series, Kluwer Academic
Publishers, 1998-present.
 - Associate Managing Editor of the Journal on Computing and
Information, Canada, 1994-1998.
 - Algorithms Group Leader. In charge of recruiting, interviewing,
evaluating and recommending faculty candidates. Founder and director
of the Laboratory for Algorithms Design, Texas A&M University, 1990-
1994.

Software

Conceived, designed and supervised the software projects listed below.

Responsibilities included proposal writing, identification of necessary skills for involved personal, hiring, supervision, preparation of periodic progress reports, testing, evaluation, deployment and publication of associated research papers.

- *An External Memory Algorithms Platform* (on going project). The goal is to provide the basis for a system to "mine" dynamic weighted graphs with several billion edges. This platform has been built as the initial infrastructure for the "Universal Information Graphs project" which is being conducted at DyDAn - the funded DHS center of excellence at Rutgers University. Four of its major components are: *HGV*, *Graph-Zoom*, *MGV*, and a *Quasi-Clique Extractor*. Each of these components is described briefly next.
 - *Hierarchical Graph Views*. A C/C++ library to compute nested partitions of semi-external graphs. It incorporates a variety of recursive graph partitioning and Markov clustering methods (in cooperation with Roman Dementiev and Ali E. Qursh).
 - *Graph-Zoom*. A Unix/Windows prototype to navigate large graphs. It is based on a hierarchy of spanning trees. It incorporates a rectangular Fish-Eye view technique to provide focus within context. It uses our own circular layout of graph hierarchies (in cooperation with J. Korn and M. Kreuseler).
 - *MGV*. Uses semi-external memory algorithms to build hierarchical partitions of weighted multi-digraphs. These partitions are mapped to the screen. They provide a virtual geography for the input stream. This virtual geography is used to guide the exploration of the data set. MGV follows the client-server paradigm and it is implemented in C and Java 3D. (In cooperation with J. Korn. *US patent 6781599*).
 - *Quasi-Clique Extractor*. Extracts subgraphs with density above certain pre-specified threshold (quasi-cliques) and uses these subgraphs as seeds to partition the vertex set (in cooperation with S. Sudarsky). The extractor is implemented in C. Some of this work has been cited in popular writings like: *American Scientist* (Graph Theory in Practice, [Sept-Oct 2006](#), Jan-Feb 2000) and [Siam News \(1999\)](#).
- *X-AGE: An Animated Graph Environment*. This is an interactive system for algorithms teaching and research; Texas A&M University, 1991-1994;
- *SEDS: A Simple Experimental Distributed System*. It provides a single machine, multiple user environment for an experimental distributed function-base; Computer Science Department and Center for Robotics Systems, University of California, Santa Barbara, CA, 1987;

- A Template to Implement Mathematical Software following the Interpretive Frame Approach; Mathematics Department, University of California, San Diego, 1984.

Books

- J. Abello, G. Cormode (eds.), [Discrete Methods in Epidemiology](#), Vol. 70 of DIMACS, AMS, May 2006.
- J. Abello, P. Pardalos, M. Resende (eds.), [Handbook of Massive Data Sets](#), Vol. 3 of the Kluwer Series on Massive Computing, 2002.
- J. Abello, J. Vitter (eds.), [External Memory Algorithms](#), Vol. 50 of the AMS-DIMACS Series in Discrete Mathematics and Theoretical Computer Science, 1999.

Patents

- J. **Abello** and J. **Korn**, “System and Method for Visualizing massive Multi-diagraphs”, US patent 6781599

Honors and Awards

- *Founder Member, Culture Analytics Network*, Danish Council of Independent Research, 2016.
- *Certificate of Achievement, Culture Analytics Program*, Institute of Pure and Applied Mathematics, University of California, Los Angeles, 2016.
- *Best Teaching Award*, Computer Science Department, Rutgers University, New Brunswick, 2015.
- *DIMACS Permanent Member*, Rutgers University, 1995;
- *First Prize Paper/Poster Award(with M. Veach)*, ACM National Conference, Phoenix, AZ, March 1994;
- Fellow of the Institute of Combinatorics and its Applications, 1993;
- *SIAM Young Investigator Award*, ICIAM, Paris, 1988;
- Post Doctoral Visitor: IMA (University of Minnesota) and MSRI(University of California, Berkeley), 1987;
- *University of California President's Post-Doctoral Fellow*, 1986-1987;
- General Dynamics Scholarship, University of California, San Diego, 1984;
- *Outstanding Teaching Award*, University of California, Santa Barbara, 1983.

Invited Lectures

- *Culture Analytics : The Arrowhead Hilbert Like Problems* , Institute of Pure and Applied Mathematics, University of California (Los Angeles), June 2016 .

- ***Hierarchical Graph Maps***, IPAM Workshop on Multi Resolution Analysis, UCLA September 2008.
- ***Massive Graph Mining***, Computer Science Departments, University of Montpellier, France and the University of Rostock, Germany, 2006. Delivered a tutorial based on the subject at IPAM, Graduate Summer School: Intelligent Extraction of Information from Graphs and High Dimensional Data, UCLA, July 2005.
- **The Majority Rule and Combinatorial Geometry (via the Symmetric Group)**, Annales du Lamsade, Paris, 2004.
- Workshop on Algorithms and Models for the Web-Graph, FOCS (Vancouver, Canada, November 2002) and Virtual Worlds and Simulation Conference, (San Antonio, TX, January 2002).
- ***Massive Multi-Digraphs***. Plenary Speaker at the Australian Conference in Optimization and Industry (Great Keppel Island, July 2001) and at the Ukrainian Academy of Sciences (Kiev, June 2000). Variations on the same subject constituted computer science colloquium talks at the University of Sidney(Australia, July 2001), University of California(Santa Barbara, October 2001), University of Arizona(Tucson, October 2001), University of Rostock(Germany, May 2002), Center for Communications Research(Princeton, June 2002), DIMACS Connect Institute(Piscataway, July 2002) and the CUNY Graduate Center(New York, Sept 2002).

Research Funding

- **NSF**
 - Computer-Human Graph Tele-discovery(with D. Chau), \$1,200,000 , 2016-2018, NSF IIS 1563816 (& 1563971);
 - Data Structures for Giga-Visualization(with A. Efrat and S. Kobourov), \$240,000, 2002-2004;
 - Hashing for Massively Parallel Computation(with A. Chin), \$31,804, 1994;
 - Combinatorial Aspects of Point Visibility, \$32,358, 1993;
 - Complexity of Restricted Independence Systems(with O. Egecioglu), \$80,222, 1989;
- **LLNL**
 - Graph Fusion in External Memory, \$100,000, DIMACS - Rutgers University, Sept - Dec 2007.
- **DHS**
 - Leader of the Universal Information Graphs Project. A project of DyDAn - Center of Excellence for Dynamic Data Analysis, Rutgers University, 2007 - 2009.
- **USDA**

- A Decision Making System for Prioritization in Salmonella Control, \$30,000, 1994;
- **EDUCATIONAL GRANTS**
 - An Honors Upper Division Sequence in Computer Science, Texas A&M University;
 - Instructional Development Grants, UCSB and UCSD, 1984 and 1985;
- **PENDING SUPPORT (Rutgers Big Data Analytics)**
 - Rutgers Traffic Nets(with J-A. Francisco and Periklis Papakonstantinou), Rutgers University, 2016;
 - Data Stories: Knowledge Representation and Reasoning of Dynamic Nonlinear Trans Medial Data(with M. Kapadia and Periklis Papakonstantinou), Rutgers University, 2016;

Professional Memberships

ACM, AMS, EACTS, ICA, IEEE, MAA, SIAM.

Selected Publications

- **Recent Publications**

[AKKV17] J. Abello, P. Klavik, J. Kratochvil, and T. Vyskocil, "*MSOL Restricted Contractibility to Planar Graphs*", Accepted for publication in Theoretical Computer Science, in print, 2017.

[PKLVTAPC17] R. Pienta, M. Kahng, Z. Lin, J. Vreeken, P. Talukdar, J. Abello, G. Parameswaran, and DH. Chau, "*Adaptive Local Exploration of Large Graphs*", In: Proceedings of the SIAM International Conference on Data Mining (SDM), SIAM, 2017.

[AMS16] J. Abello, D. Mawhirter, Kevin Sun, "*Taming a Graph Hairball: Local Exploration in a Global Context*", Invited Chapter to appear in New Ideas in Business and Consumer Analytics, P. Moscato and N. Devries, Editors, Springer Verlag, 2016.

[ADHSS16] J. Abello, D. Desimone, S. Hadlak, H. Schulz, M. Sumida,, "*Visualizing Life in a Graph Stream*", in Big Data of Complex Networks, Ed. By M. Dehmer, F. Emmert-Streib, S. Pickl, and A. Holzinger, pp 293-312, Chapman and Hall/CRC, 2016.

[PAKC15] R. Pienta, J. Abello, M. Kahng, D. Horng Chau "*Scalable graph exploration and visualization: Sensemaking challenges and opportunities*", in Big Data and Smart Computing (BigComp), 2015 .

- [WABD15] T. Williams, J. Abello, J.F. Betak, D. Desimone *"Using Data Visualization to Analyze Grade Crossing Accidents"*, in Joint Rail Conference, 2015.
- [PLKVTAPHC07] R. Pienta, Z. Lin, M. Kahng, J. Vreeken, P. P. Talukdar, J. Abello, G. Paresmeswaran, D. Horng Chau, *"Seeing the Forest through the Trees: Adaptive Local Exploration of Large Graphs"*, in ECML '07 Proceedings of the 18th European conference on Machine Learning, 418 - 429, May. 2015.
- [TA15] B. Thompson, J. Abello, *"Efficient and Time Scale-Invariant Detection of Correlated Activity in Communication Networks"*, 2015 IEEE International Conference on Data Mining Workshop, Nov. 2015.
- [AHSS14] J. Abello, S. Hadlak, H. Schumann, H. Schulz, *"A Modular Degree-of-Interest Specification for the Visual Analysis of Large Dynamic Networks"*, IEEE Transactions in Visualization and Computer Graphics, 12 , 2014.
- [AAKMMMT14] J. Abello, D. Archambault, J. Kennedy, S. Kobourov, K.-L. Ma, S. Miksch, C. Muedler, A.C. Telea, *"Temporal Multivariate Networks"*, in Multivariate Network Visualization, Ed. by A. Kerren, H. Purchase, and M. Ward, LNCS 8380, Springer Verlag (2014) 151-169.
- [AQ13] J. Abello, F. Quelroy, *"Fixed Points of Degree Peeling"*, ASONAM 2013, Advances in Social Networks, IEEE/ACM International Conference, Niagara Falls, Canada, August 2013.
- [AQ14] J. Abello, F. Quelroy, *"Network decomposition into fixed points of degree peeling"*, Social Network Analysis and Mining, Dec. 2014, 4:191.
- [ABT12] J. Abello, P. Broadwell, T. Tangherlini, *"Computational Folkloristics"*, *Communications of the ACM*, (2012).
- [ACP12] J. Abello, M. Chen, N. Parikh, *"Time Discrepant Shipments in Manifest Data"*, in Handbook of Operations Research for Homeland Security, J. Herrmann (ed.), Springer Verlag, 2012.
- [AKKV12] J. Abello, P. Klavik, J. Kratochvil, T. Vyskocil, *"MSOL restricted contractibility to planar graphs"*, in IPEC'12 Proceedings of the 7th international conference on Parameterized and Exact Computation, pp. 194-205, Springer-Verlag Berlin, Heidelberg, 2012.
- [ADE10] J. Abello, N. Devanur, T. Eliassi Rad, *"Detecting Novel Discrepancies in Communication Networks"*, ICDM 2010, The 10th International Conference on Data Mining, Sidney, Australia, 2010.
- [ATS08] J. Abello, C. Tominski, H. Schumann, *"CGV: An Interactive Graph Visualization System"*, in Computers & Graphics 33.6 (2009): 660-678.

- **In Progress**

[AC07] J. Abello and M. Capalbo, "*Finding Max Cliques in Power Law Graphs with high Clustering Coefficients*", Submitted to Internet Mathematics.

[AD07] J. Abello and R. Dementiev, "*Semi-External Induced Subgraphs*", under review.

[ADQ08] J. Abello, R. Dementiev and A. E. Qursh, "*HGV: A C/C++ library to generate Hierarchical Graph Views*", in preparation.

- **Massive Data Sets**

[ACF06] J. Abello, G. Cormode, D. Fradkin, D. Madigan, O. Melnik and I. Muchnik, "*Selected Data Mining Concepts, In Discrete Methods in Epidemiology*", vol. 70 of the AMS-DIMACS Series, Co-edited by J. Abello and G. Cormode, pp 1- 40, 2006.

[AP06] J. Abello and A. Pogel, "*Graph Partitions and Concept Lattices*", In Discrete Methods in Epidemiology, vol. 70 of the AMS-DIMACS Series, Co-edited by J. Abello and G. Cormode, pp 115 - 138, 2006.

[AC06] J. Abello and M. Capalbo, "*Random Graphs (and the Spread of Infections in a Social Network)*", In Discrete Methods in Epidemiology, Vol. 70 of the AMS-DIMACS Series, Co-edited by J. Abello and G. Cormode, pp 115 - 138, 2006.

[A04A] J. Abello, "[*Hierarchical Graph Maps*](#)", *Computers & Graphics* 28(3): 345-359 (2004).

[AP04] J. Abello, Alex J. Pogel, Lance Miller, "*Breadth First Search Graph Partitions and Concept Lattices*", *J. UCS* 10(8): 934 -954 (2004).

[AH04] J. Abello and Frank van Ham, "[*Matrix Zoom: A Visual Interface to Semi-External Graphs*](#)", IEEE InfoVis Proceedings, pp 183 - 190, 2004.

[AK03] J. Abello, Yannis Kotidis, "*Hierarchical Graph Indexing*", *CIKM 2003*: 453-460.

[AB02] J. Abello, Adam L. Buchsbaum, Jeffery Westbrook, "[*A Functional Approach to External Graph Algorithms*](#)", *Algorithmica* 32(3): 437-458 (2002).

[AK02] J. Abello, J. Korn, "[*MGV: A System for Visualizing Massive Multidigraphs*](#)", IEEE Transactions on Visualization and Computer Graphics, Vol. 8, No 1, January-March 2002.

[SA02] J. F. Sibeyn, J. Abello, U. Meyer, "[Heuristics for Semi-External Depth First Search on Directed Graphs](#)", ACM Symposium on Parallel Algorithms and Architectures, *SPAA 2002*: 282-292.

[AR02] J. Abello, M. Resende, and S. Sudarsky, "*Massive Quasi-Clique Detection*" In Proceedings of Latinoamerican Informatics, May 2002, Springer Verlag LNCS.

[AP99] J. Abello, P. Pardalos, M. Resende, "*On Very Large Maximum Clique Problems*", in External Memory Algorithms, (J. Abello and J. Vitter, Editors), AMS-DIMACS Series in Discrete Mathematics and Theoretical Computer Science, Vol. 50, pp 119-130, 1999.

- **Visualization**

[AGST07] J. Abello, B. Gaudin, H. Schulz and C. Tominski, "*Name That Cluster*", IEEE Information Visualization Symposium, Sacramento, CA, October 2007.

[AH06] J. Abello, F. van Ham, and N. Krishnan, "[Ask-GraphView-: A Large Scale Graph Visualization System](#)", IEEE Transactions in Visualization and Computer Graphics, *12*(5): 669-676 (2006)

[TA06] C. Tominski, J. Abello, F. van Ham, and H. Schumann, "[Fisheye Tree Views and Lenses for Graph Visualization](#)", In Proceedings of the Conference on Information Visualization, IV 2006, London, July 05 - 07, pp 17-25, 2006.

[AK04] J. Abello, S. Kobourov, R. Yusufov, "Visualizing Large Graphs with Compound Fish Eye Views and Treemaps", *Graph Drawing*, 2004:431-441.

[TA04] C. Tominski, J. Abello and Heidrun Schumann: "[Axes-based visualizations with radial layouts](#)", Proceedings of the 19th ACM Symposium on Applied Computing, Nicosia, Cyprus, March 14-17, *SAC 2004*: 1242-1247.

[AS03] J. Abello, H. Schumann, C. Tominski, "[Axes Based Visualizations for Time Series Data](#)", in IEEE InfoVis Poster Proceedings, Seattle, October 19-24, 2003

[AKK02] J. Abello, J. Korn, and M. Kreuzeler, "[Navigating Giga-Graphs](#)", In ACM Proceedings of Advanced Visualization Interfaces (AVI), pp 290-299, Trento, Italy, 2002.

[AF01] J. Abello, I. Finocchi, and J. Korn, "[Graph Sketches](#)", In IEEE InfoVis Proceedings, pp 67-71, San Diego, Ca, October 2001.

[AK00] J. Abello, J. Korn, "[Visualizing Massive Multi-Digraphs](#)", In IEEE InfoVis Proceedings, pp 39-48, Salk Lake City, Utah, October 2000.

[AK99] J. Abello, S. Krishnan, "[Navigating Graph Surfaces](#)", 4th Intl. Congress on Industrial and Applied Mathematics (ICIAM), Edinburg, July

1999; *Approximation and Complexity in Numerical Optimization: Continuous and Discrete Problems*, (P. M. Pardalos, editor), Kluwer Academic Publishers, pp. 1-12, 1999.

[AKG99] J. Abello, E. Koutsofios, E. Gansner and S. North, "[Large-Scale Network Visualization](#)", Computer Graphics, SIGGRAPH Newsletter, Vol. 33, Number 3, August 1999, pp. 13-15.

[AS94] J. Abello, C. Smith, "[An Interpreted Algorithm Animation System](#)", Journal on Computing and Information, pp 1569-1588, 1994.

[ASV94] J. Abello, S. Sudarsky, T. Veatch, J. Waller, "AGE: An Animated Graph Environment", in AMS-DIMACS series in Discrete Mathematics and Theoretical Computer Science, N. Dean and G. Shannon (Eds.), vol. 15, pp 57-69, 1994.

- **Discrete and Computational geometry**

[AK02] J. Abello, K. Kumar, "[Visibility Graphs and Oriented Matroids](#)", Discrete and Computational Geometry, vol. 28, pp. 449-465, 2002.

[AC98] J. Abello, V. E. Castro, T. Shermer, J. Urrutia, "Illumination of Orthogonal Polygons with Orthogonal Floodlights", International Journal on Computational Geometry and Applications, vol. 8, No 1, pp 25-38, 1998.

[AG98] J. Abello, E. Gansner, "Short and Smooth Polygonal Paths", LNCS vol. 1380, pp 151-162, 1998.

[AE95] J. Abello, O. Egecioglu, K. Kumar, "Visibility Graphs of Staircase Polygons and the Weak Bruhat Order I: From Visibility Graphs to Maximal Chains", Discrete and Computational Geometry, Vol. 14, No 3, 1995, pp 331-358.

[AK95] J. Abello, K. Kumar, "Visibility Graphs of 2-Spiral Polygons", LNCS vol. 911, pp.1-15, 1995.

[AE93] J. Abello, O. Egecioglu, "Visibility Graphs of Staircase Polygons with Uniform Step Length", Intl. Journal of Computational Geometry and Applications, Vol. 3, No.1, 1993, pp. 27-37.

[AH92] J. Abello, L. Hua, and S. Pisupati, "On Visibility Graphs of Simple Polygons", Congressus Numerantium, Vol. 90, pp. 119-128, 1992.

- **Combinatorics, Algorithms and Complexity**

[A04B] J. Abello, "[The Majority Rule and Combinatorial Geometry \(via the Symmetric Group\)](#)", Annales Du Lamsade, No. 3, pp 1- 13, October 2004.

[AB01] J. Abello, S. Butenko, P. Pardalos, and M. Resende, "[Finding Independent Sets in a Graph Using Continuous Multivariable Polynomial Formulations](#)", Journal of Global Optimization, Vol. 21, pp. 111-137, 2001.

[AD97] J. Abello, S. Dolev, "[On the Computational Power of Self-Stabilizing Systems](#)", Theoretical Computer Science, Vol. 182, No 1-2, pp. 159-170, August 1997.

[AK95] J. Abello and K. Kumar, "*On the Complexity of some Synthetic Problems in Computational Geometry*", J. Computing and Information, pp. 92-110, 1995.

[SA95] J. Shawe-Taylor, C. Domingo, H. Bodlaender, J. Abello, "[Learning Minor Closed Graph Classes with Membership and Equivalence Queries](#)", NeuroCOLT TRS, NC-TR-94-014, Jan 1995.

[JK94] J. Abello, V. Kreinovich, H.T. Nguyen, S. Sudarsky, J. Yen, "*Computing an Appropriate Control Strategy Based Only on a Given Plant's Rule-Based Model can be Hard. (NP-Hard)*", Proceedings of NAFIPS/IFIS/NASA 1994, pp. 331-332, San Antonio, December 18-21, 1994.

[AH93] J. Abello, A. Hoang, and J. Russell, "[A Hierarchy of Pattern Recognition Algorithms for the Diagnosis of Sucker Rod Pumped Wells](#)", J. Computing and Information, pp. 359-364, IEEE, Ontario, May 1993.

[AK93] J. Abello, K. Kumar, and O. Egecioglu, "[A Combinatorial View of Visibility Graphs of Polygons](#)", IEEE Proceedings of International Conference on Computing and Information, 1993, pp. 87-92.

[AH92] J. Abello, L. Hua, and M. Lu, "*An Efficient Parallel Algorithm for the Longest Common Subsequence Problem*", LNCS, Springer Verlag, Vol. 4, 1992, pp. 123-130.

[JA91] J. Abello, "[The Weak Bruhat Order, Consistent Sets and Catalan Numbers](#)", SIAM Journal on Discrete Mathematics, 4(1), pp 1-16, February 1991.

[AF91] J. Abello, M. Fellows, J. Stillwell, "*On the Complexity and Combinatorics of Covering Finite Complexes*", Australasian Journal of Combinatorics, Vol. 4, 1991.

[JA86] J. Abello, "*Algorithms for Consistent Sets*", Congressus Numerantium, Vol. 53, pp. 23-38, 1986.

[JA85] J. Abello, "*Intrinsic Limitations of the Majority Rule, an Algorithmic Approach*", SIAM J. Alg. Disc. Meth., 6(1), pp 133-144, January 1985.

[AJ84] J. Abello, C. Johnson, "*How Large are Transitive Simple Majority Domains*", SIAM J. Alg. Disc. Meth., 5(4), pp 603-618, 1984.

- **Under Review**

[AF] J. Abello and P. Fishburn, "*Real vs. Rational Visibility*".

[AC] J. Abello and J. Chen, "*Some Results on Graph Emulation*".

Grant Reports

J. Abello, "*Decision Tools for Salmonella Control*", Report to the USDA, TR 94-007, CS Dept, Texas A&M University, 1994.

J. Abello and O. Egecioglu, "*Complexity of Algorithms for Some Restricted Independence Systems*", Capital City Conference on Combinatorics and Complexity, WashingtonDC, July 1989, and Eleventh British Combinatorial Conference, London, July 1987.

Theses

J. Abello, "*A Study of an Independence System Arising in Group Choice via the Weak Bruhat Order*", Ph.D. Thesis, University of California, San Diego, 1985.

J. Abello, "*Computability, Logic and Limitations of the Formal Systems*", MS Thesis, University of Puerto Rico, Mayaguez, PR, 1979.

Research Outlook

A possible way to describe the current stage of my career is that of an experimental computer scientist with a solid theoretical foundation. During the past two decades I became fascinated by the fundamental questions that have been arising from the exploration of *very large data sets*, (for us a data set is very large if it does not fit on the available *RAM*).

A variety of massive data sets exhibit an underlying structure that can be modeled as dynamic weighted multi-digraphs with a collection of edge dependent attributes that are application dependent (Web Queries Co-occurrence, Internet data and Telecommunications traffic are prime examples).

When a multi-digraph does not fit in RAM many of the classical algorithms break down. Operations that we usually take for granted, like graph traversing, get wretched when they are faced with the I/O bottleneck. Even though cluster of PC's or enough Parallel I/O are currently used to alleviate this problem, the truth of the matter is that these are just temporal solutions. Behind the scenes, there are fundamental computational questions that are reminiscent of the challenges faced by early computing pioneers. From my view point, sequential media is outgrowing random access storage at a speed and cost that makes imperative to approach the problem of massive data sets as a massive distributed network computing problem instead of using variations of Von Newman architectures that are handicapped by their inherent bottlenecks. This is an area with great potential if we can built off the shelf cost effective computing platforms for large data analysis research.

My confidence for pursuing this area comes in part as a result of 20 years of experience in developing and implementing techniques to process, navigate, analyze and visualize multi-digraphs, arising from the web and the telecommunications industry. The corresponding data sets sizes range from

million to several billion edges (please see our contributions to this area in the publication summary). One of the clear messages we have learned is that RAM and processor investments alone are not able to keep up with the data generation ability of the computing and communication devices that are becoming so common in our daily endeavors.

- **Data Streams**

In light of the previous discussion, another research direction revolves around algorithms and architectures that operate on sets of data streams each of which is accessible only through a small random access window. These architectures shall be flexible enough to be able to incorporate in their processor network special agents that interact with the external world on a semi-continuous fashion. Some of the technological tools necessary for this undertaking include mobile Internet-able devices, a fast local interconnection network, a PC cluster, a basic visualization platform, I/O libraries, languages and system performance tools and web server technology. The theoretical tools with potential applicability are rooted in circuit and communication complexity, random graph theory, combinatorics, game theory, optimization, distributed and succinct data structures, probability, statistics, algebraic topology and dynamical systems. This type of research calls for a highly interdisciplinary team and a large portion of the necessary hardware and software is readily available. There is a plethora of large driven data applications that will benefit from this undertaking. I would like to contribute to the design and development of cost effective hardware/software platforms that facilitate access, navigation, visualization, analysis and sensemaking of “*large*” data sets.

- **Visual Metaphors**

Another major topic of my research vision emphasizes the creation of computational efficient visual metaphors for the representation, navigation and analysis of very large data sets. The rationale is that these metaphors shall be useful not only for the experimentation stages of some of the research topics described above but they shall also become useful for the analysis of data associated with the organization where the research is undertaken.

- **Applied Computational Geometry**

Combinatorial Geometry has become a quite relevant tool for some problems in visualization and computer graphics. These include visibility representations of graphs and partially ordered sets; interactive rendering of polygonal terrains and volumetric data sets arising in finance and medicine.

Educational Outlook

I have been the recipient of several teaching awards at different levels in the educational system. During my undergraduate studies in Mathematics and Physics, I pursued a specialization in Pedagogy.

Arguably, the fast pace of technological and economical developments is causing an erosion on the foundation of several scientific disciplines. Our era offers a golden opportunity for Computer Science, Mathematics, Physics, Engineering, Biology and the Social Sciences to nurture each other in a positive way. There is the need to develop programs that are *driven by a hierarchy of interdisciplinary computational challenges that students complete during their education*. In the next paragraph, I describe an example of such an approach.

With funds provided by two educational grants, I founded and directed a Laboratory for Algorithms Design. One of its central objectives was to develop educational software to support some classes in the undergraduate curriculum. Unix tools were developed to enhance some fundamental notions that included Turing Machines, Graph Algorithms, the Symmetric Group, Concurrency control and a host of Local Heuristics. A central project in this regard was a client-server system named "AGE: An Animated Graph Environment". It provided the basis of an interactive system for algorithms teaching and student research. In total 43 applications were based on this system. It is worth to point out that all these applications were developed by students that were using AGE as a supporting tool for their classes. This illustrates a possible direction to provide technological training with a solid theoretical backing. I believe that knowledge transfer must be structured conceptually; its delivery fun, amusing and entertaining, and its computational experimentation sound and rigorous.

Courses Taught

James Abello has taught Computer Programming, Software Fabrication, Operating Systems, Scientific Computing, Discrete Mathematics, Data Structures, Analysis of Algorithms (Sequential, Parallel and Distributed), Formal Languages, Computability, Complexity Theory, Combinatorial Optimization, Operations Research, Calculus, Linear Algebra, and Numerical Analysis, both at the undergraduate and graduate levels. Algorithms, Java, Web Based Computing and Information Visualization are his current teaching interests.

Student Research Advising

- **Ph.D. External Supervisor**

François Queyroi, "*Partitionnement de grands graphes : mesures, algorithmes et visualisation*". (*Graph Partitioning : measures, algorithms and*

visualization).”, Computer Science Department, University of Bordeaux, France 2013.

Hans-Jörg Schulz , “*Explorative Graph Visualization*”, University of Rostock, 2010.

Christian Tominski, “*Event-Based Visualization for User-Centered Visual Analysis*”, PhD thesis, University of Rostock, Germany, 2006.

Frank van Ham, “*Interactive Visualization of Large State Spaces*”, PhD thesis, ISBN 90-386-0704-0, Technische Universiteit Eindhoven, 2005.

- **Ph.D. Students Supervised**

Krishna Kumar, “*Combinatorial Aspects of Point Visibility*”, Computer Science Department, Texas A&M University, August 1993.

- **M.S. Students Supervised**

Pritish Sahu, “*Data Facets Navigation*”, Computer Science Department, Rutgers University, May 2017.

Timothy Veach, “*An Animated Graph Environment*”, Computer Science Department, Texas A&M University, September 1990.

Sanjay Joshi, “*Some Algorithmic Results in Graph Imbeddings*”, Computer Science Department, Texas A&M University, December 1990 (Co-Chairman).

Ronald Chambers, “*Heuristics for the Traveling Salesman Problem*”, Computer Science Department, Texas A&M University, December 1991.

Sekhar Pisupati, “*Polynomial Algorithms for Visibility Graphs of Staircase Polygons*”, Computer Science Department, Texas A&M University, December 1991.

Chris Roda, “*An Animated Interface to the AGE System*”, Computer Science Department, Texas A&M University, August 1992.

Anne Hwang, “*Pattern Matching for the Evaluation of Sucker-Rod Pumped Wells*”, Petroleum Engineering Department, Texas A&M University, September 1992 (Co-Chairman).

Don Sonom, “*Visualization of Heuristics for Some NP-Complete Problems*”, Computer Science Department, Texas A&M University, December 1993.

Craig Smith, “*A Graphics-based Language for Algorithm Animation*”, Computer Science Department, Texas A&M University, May 1994.

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Note: James Abello is a US Citizen. Additional references and his full vitae is available upon request.