

Math Alumni Make a Mark in Data Science

Boehringer Ingelheim, a pharmaceutical company based in Ingelheim, Germany, had a problem: In medical research it is important to know the biological responses to the compounds in drugs, but it is very expensive to determine this in trials because of the enormous number of possible combinations which must be tested. They needed a reliable method to determine the response to these compounds based solely on knowledge of their molecular properties (like size, shape, or elemental constitution). They had an extensive database of existing compounds and responses and wanted to use it to try to predict the response to new compounds.

So they approached Kaggle, a San Francisco based company which specializes in predictive modeling competitions. Companies, governments and researchers present data sets and problems and scientists then compete to produce the best solutions. At the end of a competition, the host pays prize money in exchange for the intellectual property behind the winning models.

Thus was born the “Predicting a Biological Response” competition which, by the end of its three month run, had attracted close to 9,000 entries from more than 800 data scientists.



Jeremy Achin and Tom DeGodoy

Competitors were given 1,776 different variables, each representing a molecular descriptor pertaining to a characteristic of the molecule, and experimental data relating to actual biological responses. The aim was to predict which compounds hold the greatest promise so experimental efforts could be focused on them, while avoiding having to test others only to have them ultimately prove ineffective.

In one of the first times “gamification” has provided such a practical contribution to drug development, and despite the fact that the competitors had no particular knowledge of the pharmaceutical industry, results of the competition revealed the best models to be more than 25% more effective than those currently in use. The winning team had three contestants, Jeremy Achin,

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Alex Samarov Retires

Contributed by Professor Charlie Byrne

Professor Alex Samarov retired this past spring after twenty-seven years in our department. Alex received his PhD in Statistics in 1977 from the USSR Academy of Sciences in Moscow. He and his family came to the USA in 1978. After teaching at MIT for five years, he joined UML in 1985 and quickly became one of the most valued members of the department, teaching most of the courses in our Probability and Statistics option.

Alex is a well known academic who has held visiting professorships at Berkeley, and at universities in Italy, Israel, England, France, Germany, and Austria.

Alex is also a voracious reader. A few years ago, I mentioned to him that I had come across what I thought was an obscure novel by Umberto Eco. I asked Alex if he knew of it. He replied that he had read it, and in the original Italian.



Alex Samarov

We hope to get permission to hire a new faculty member to teach Alex’s graduate statistics courses. However, we don’t say “to replace Alex”, which we know is not possible.

PRIME Partnership

The Departments of Mathematical Sciences and English are collaborating with the Graduate School of Education on a state-funded program called PRIME (Partnership for Readiness in Math and English). UMass Lowell faculty members are working with faculty and administrators from Lowell High School and the Lawrence High Schools to develop programs designed to improve high school students’ college readiness in math and English. The goal is to ease the transition from Lowell and Lawrence High Schools to UMass Lowell. The program is in its third year, and we hope to see tangible results with the entering class of fall 2013.

The fall semester is well under way, and many things are happening on campus. The new Emerging Technologies and Innovation Center opened last week, and other new buildings are expected to open this year. We are hoping for a good season for the hockey team.

Congratulations to spring and summer graduates Jessica Barker, Matthew Brady, Will Burstein, Brendan DeCourcy, Olivia Ellis, Caroline C. Gagnon, Jonathan Geary, Elhoussine Ghardi, Gregory H. Hunter, Kylie Kane, Brianne Lemoine, Mikhail Lomakin, Ashley Metcalf, Kyle Monico, Abdelwahed Nabat, Tyler Ouellet, Timothy C. Owen, Jeffrey M. Rackauskas, Dean Serrentino, Jr., Peter Steere, and Jacob Williams.

Congratulations to Tibor Beke and Ron Brent, the 2012 winners of the Department of Mathematical Sciences Teaching Excellence Awards.

Congratulations to Kiwi, who won the 2012 Faculty Award for the Advancement of Teaching and Learning in the Sciences established by Dr. Susan Pasquale and Mr. Ron Boudreau.

Congratulations to Professor Indu Anand, who was recently awarded a patent for *Method of Developing Educational Materials Based on Multiple-Choice Questions*.

Congratulations to alumnus Angus MacDonald, who won the Northeast 10 Conference Scholar-Athlete Excellence Award last spring and was named an all-American in the mile and the distance medley relay.

Congratulations to alumni Jeremy Achin and Tom DeGodoy, who recently took first place in one of the largest predictive modeling competitions in history (over 8,800 entries from over 700 of the world's top data scientists). Jeremy and Tom have started their own data science company.

Congratulations also to Kiwi, who got Tom and Jeremy interested in modeling when they were students here via the COMAP Mathematical Contest in Modeling.

Last May 4 we held our annual Alumni/Awards dinner at the Inn and Conference Center. Duncan Pettengill, Stephanie Quintal, and Owen Welsh were awarded Arthur S. Zamanakos scholarships; John Cavalieri and Mike Lunderville were awarded Bernard and Yana Shapiro scholarships; Franck Kamayou won the Richardson-Bedell scholarship; and Ghazal Kayal was awarded the Mary Hall Prize for best performance in Calculus I. Teressa Finch was named Outstanding Graduate Student.

We are fortunate to have two new adjunct faculty members in the department this fall, both of whom completed their MS degrees at UMass Lowell last spring. Welcome to Teressa Finch and Erica Yankowskas.

Last July I attended the annual meeting of the Society for Industrial and Applied Mathematics. I am happy to report that applied math is flourishing as never before. My favorite comment from the conference was a twist on the old saying "When the only tool you have is a hammer, everything looks like a nail." In his excellent talk "Computing Essentials: What SIAM Members Should Know About Emerging Architectures," Mike Heroux of Sandia National Laboratory quipped "When C++ is your hammer, everything looks like your thumb."

Best wishes for an enjoyable fall season, and early wishes for a happy holiday season. Please keep in touch, and stop in to visit the next time you are in the area. Remember to check out our web site for items of interest. Check out *Cotangents*, our new blog: <http://blog.uml.edu/cotangents/>



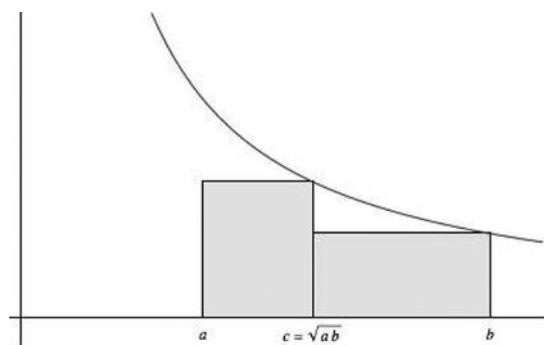
Steve Pennell

The Tangents Problem

The Fall 2012 Problem: Imagine a flat-bottomed pot with circular cross-section of radius 4 inches. What is the radius of the marble, with radius $0 < r \leq 4$ inches which when placed in the bottom of the pot, requires the largest amount of water to be completely covered?

The Spring 2012 Problem: Let $h(x) = 1/x$. Consider all partitions of the interval $[1, 2]$ into four subintervals of any size determined by three interior points $x_1, x_2,$ and x_3 . For each such partition, the integral of $h(x)$ from 1 to 2 can be approximated by lower sums where the height of each inscribed rectangle below the curve $y = h(x)$ is the value of h at the right endpoint of the corresponding subinterval. Find the partition that maximizes the value of the lower sum.

Solution: The partition that maximizes the lower sum is $x_1 = 2^{1/4}, x_2 = 2^{1/2},$ and $x_3 = 2^{3/4}$. Although you can derive this result by maximizing the lower sum as a function of the three interior points, you can infer it by observing that the maximum lower sum with two subintervals for the integral of $h(x)$ from a to b has as its interior point the geometric mean of a and b, \sqrt{ab} . Tom Walsh (B. S. 1995) sent us the solution while he was traveling in France.



Up to four correct solutions from among all that are submitted by February 1, 2013 will earn the solver a "UML Math" T-shirt. You may submit your solution to mathematics@uml.edu or mail it to Ken Levasseur, Department of Mathematical Sciences, North Campus/Olney Hall, UMass Lowell, Lowell MA 01854.

Steve Pennell, Chair

Writers: Ken Levasseur, Ann Marie Hurley, Dan Klain, Ravi Montenegro, Guntram Mueller (emeritus), Raj Prasad, Jim Propp, Marvin Stick, Charlie Byrne

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Tom DeGodoy (both UML math alumni) and Sergey Yurgenson, a Research Associate in Neurobiology at Harvard Medical School.

Jeremy and Tom met while studying Mathematics and Physics at U. Mass. Lowell and were participants in the 2001 Mathematical Competition in Modeling hosted by the Consortium of Mathematics and its Applications based in Bedford, Massachusetts. In this competition they, along with Amanda Mederios, spent four days modeling and simulating hurricane evacuation in South Carolina in order to minimize the time required to safely evacuate residents from the coast, earning a prized meritorious ranking for their report.

After leaving UML, Jeremy went to work for Allmerica Financial (now Hanover Insurance) where he was first exposed to predictive modeling and “knew that was what I wanted to do with my life.” A year later he recruited Tom to join him. Believing they could do better than the expensive consultants, they spent their spare time building their own models. They convinced the president of the company to use them instead of models designed by consultants, despite protests of the modeling being turned over to “two kids.”

In 2006 they left Hanover Insurance to work for Travelers Insurance because of the company’s advanced Research and Development department. Recently Tom and Jeremy started putting more effort into Kaggle competitions and were two of only 15 data scientists (out of some 40,000) invited to take part in an invitation-only competition. They placed third, and have since left the insurance industry to work on their own company, DataRobot, to “change the way people build predictive models.” They went on to win one of the largest data mining competitions ever held.

The department is extremely proud of them and their achievements. Congratulations to them both.

Here are links to the companies / organizations mentioned in the article

<http://www.boehringer-ingenelheim.com>

<http://www.kaggle.com>

<http://www.datarobot.com/>

<http://www.comap.com>

UML Mathematical Sciences Online

Have you visited Mathematical Sciences web page lately? Our address is <http://faculty.uml.edu/math>

You can follow us on Twitter: <http://twitter.com/UMassLowellMath>.

Faculty Update

In April 2012, Prof. James Propp organized an event at the Mathematical Sciences Research Institute in Berkeley, California, entitled “Wild



Image designed by Benjamin Young

Beauty: Postcards from Mathematical Worlds.” The event was a public exhibit of images and simulations related to the field of random spatial processes. For images, and a full transcript and video of Prof. Propp’s talk, see <http://msri.org/wildbeauty/>.

Professor Tibor Beke’s 2012-13 sabbatical leave had already proven quite fruitful. He recently had a paper published:

Abstract elementary classes and accessible categories, joint with Jiri Rosicky, *Annals of Pure and Applied Logic*, vol. 163, issue 12, 2012, pp. 2008-2017

In July 2012, he gave a talk at the Lisbon Institute of Technology (Lisbon, Portugal) entitled “The sign pattern theorem.” He is spending November 2012 as guest of the Department of Mathematics, Masaryk University in Brno, Czech Republic.

Mathematical Sciences Professor Lee Jones has teamed up with colleagues in the Civil and Environmental Engineering Department to win two grants from the New England University Traffic Center.

“Intelligent Transportation Systems Equipment Placement for Safety and Mobility” will provide state agencies with a decision support model that supplements the state-of-the-art practice of mostly relying on the experience and judgment of professionals. The areas of mathematical research include optimization, applied combinatorics and graph theory.

“Robust Performance of Transportation Networks Using Quantile Metrics” will develop new metrics for network assessment by taking explicit account of demand variability and uncertainty. The metrics consist of the calculation of quantile network costs. The assessment methodology is then used to develop management and control strategies that result in robust network performance. The mathematical and statistical areas of research for the project include Monte Carlo generation of rectangular tables, minimax statistical estimation and optimization.

Alumni Update

Andrew Miller (BS Physics '66-Lowell Tech/MS Mathematics '72-Lowell Tech) is Professor Emeritus at Berkshire Community College (Pittsfield Mass), retiring in 2011. He writes



Andrew Miller

As an undergraduate, Professor Andrew Ouellette inspired me to become a teacher. He hired me as a Teaching Assistant in 1970 to teach two courses in Differential and two in Integral Calculus each semester while pursuing the MS Math at Lowell Technological Institute. Had LTI offered a Math major when this Lowell native started there, I would have probably have gone right into Math. In an assembly designed to help students choose majors, Dr. Charles Mingins, Chair of Physics, took his turn and spoke to us second semester freshman in Cumnock about how Physics had lots of math. My love for Applied Math grew from that. I also did an MS Computer and Systems Engineering at Rensselaer Polytechnic Institute '80.

In 2007, Prof. Miller coached at team of sophomores at Berkshire Community College (Sophomores) to a "Meritorious Winner" finish in the Interdisciplinary Contest in Modeling run by COMAP. The team worked to create a better way to handle the US Organ Transplant-Kidney Exchange Problem. The team placed ninth out of 36 US teams, and were in the top 15% world-wide. This was a very impressive showing for one of the few two-year colleges in the competition.

2012 Alumni-Awards Banquet

Next Banquet set for May 3, 2013

The 2012 Alumni-Awards Banquet was held at the UMass Lowell Inn & Conference Center on May 4. Attendees included Dean Tamarin, alumni, students, staff, and faculty. Attendees came to wine, dine and congratulate our 2012 scholarship winners. The following awards were announced.

- Outstanding Graduate Student: Teresa Finch
- Mary Hall Prize winner: Ghazal Kayal
- Richardson-Bedell Scholar: Franck Kamayou
- Bernie and Yana Shapiro Scholars: Michelle Labonte, Michael Lunderville and John Cavalieri
- Arthur Zamanakos Scholars: Stephanie Quintal, Owen Welsh and Duncan Pettengill

The 2013 Alumni Reception/Awards Banquet will be on May 3 at the UMass Lowell Inn & Conference Center on 50 Warren St., Lowell. All alumni are welcome to attend. Visit <http://faculty.uml.edu/math> for details.



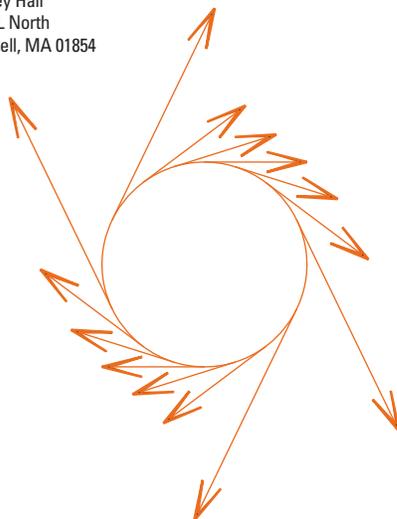
What Are You Up To?

Want to keep your classmates up to date on what you're doing and where you are? Take a few moments to tell us where you are, and whatever else you might like to share.

We can be contacted by mail at Department of Mathematical Sciences, North Campus, UMass Lowell, Lowell MA 01854. Telephone: (978) 934-2410. Email: mathematics@uml.edu

You might also wish to contact our Office of Alumni Relations, Southwick Hall 250, UML North, Lowell MA 01854-3629. Toll free telephone: (877) UML-ALUM. Email: Alumni_Office@uml.edu

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