BELGIAN MATHEMATICAL
SOCIETY

Comité National de Mathématique   CNM

$$C \quad \underset{N}{W} \quad M$$

NCW   Nationaal Comite voor Wiskunde

BMS-NCM NEWS
—
No 69, September 15, 2008

Letter from the editor

Welcome

to this September, 2008- Issue of our Newsletter.
Have a nice fall semester

Regards, Françoise

Contents

1 News from the BMS

The General Assembly will take place on **October 15, 2008,** during lunch time, in Brussels.

More information will be available in the next Newsletter but you can already contact our President Catherine Finet (Catherine.Finet@umh.ac.be).

Have also a look at

> http://www.cs.kuleuven.be/conference/ranking/

for a joint meeting NCM-BMS on **Wednesday October 15, 2008**

2 News from the NCM

There will be a joint meeting NCM-BMS on Wednesday 15 October 2008 at the Academy. For more information see: http://www.cs.kuleuven.be/cwis/research/nalag/research/workshops/ranking.

The annual meeting of the NCM will take place on **Wednesday October 15 at 5 PM.**

3   Meetings, Conferences, Lectures

3.1   October 2008

Meeting on Saturday October 10, 2008 at the ULB (see the announcement at the end of this Newsletter)

<div align="center">

Une journée sur Paul Libois
Samedi 10 Octobre, ULB

</div>

See the website http://www.math.ua.ac.be/bbdays/ for the meeting

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Categories in algebra, geometry and logic
Academy, 10-11 october

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The BMS and the NCM organize a symposium at the Royal Academy in Brussels

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The Mathematics of Ranking
Academy, October 15, 2008

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See the folder and call for papers at the end of this Newsletter.
Please **register at the website** http://www.cs.kuleuven.be/conference/ranking/

3.2   November 2008

<div align="center">

Workshop "Operator algebraic aspects of quantum groups"
K.U.Leuven, November 10 till November 12, 2008.

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Web site: http://wis.kuleuven.be/analyse/workshopNov2008/
Confirmed main speakers include T.Banica, B.Collins, S.Neshveyev, A.Thom, R.Tomatsu, R.Vergnioux and S.L.Woronowicz.
Funding available for PhD students and young researchers.

<div align="center">

Groupe de contact FNRS en Géométrie Différentielle
Domaine des Masures, Han-sur-Lesse, November 12-14, 2008

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This meeting will take place at the Domaine des Masures in Han-sur-Lesse from Wednesday, November 12th, around 2pm, to Friday, November 14th, around noon. The list of speakers, as well as other practical information, will be available on

<div align="center">

http://homepages.ulb.ac.be/∼fbourgeo/contact/FNRScontact.html

</div>

If you intend to participate, please register on the meeting website as soon as possible, since only limited space is available.

<div align="right">

Frédéric Bourgeois (`fbourgeo@ulb.ac.be`)

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4 Summary of PhD theses

<div align="center">

Firm completions in metrically generated constructs
with applications to function spaces and sobrification
Eva Vandersmissen
May 27, 2008; Vakgroep Wiskunde, Vrije Universiteit Brussel
Advisor: Eva Colebunders

</div>

The setting of this work is the one of metrically generated constructs. Roughly speaking, metrically generated constructs are topological constructs which are "generated" by their metrizable objects. The main feature of metrically generated constructs is that they can be coreflectively embedded in some model category **M** via some saturation ξ, and so any metrically generated construct can be described as a construct in which the objects are sets structured by a ξ-saturated collection of quasi-pre-metrics, a representation which provides us with a very natural description of the morphisms. This isomorphic description allows for a unifying treatment of all metrically generated constructs.

In this work we fully exploit the setting of metrically generated constructs for the study of uniqueness of completion in a metrically generated construct. The behaviour of the the classical completion theory for T_0 uniform spaces is a guiding example for the completion theories developed in this thesis. We study completion in a metrically generated construct **X** as a $\mathcal{U}$-reflector **R** on the subconstruct $\mathbf{X}_0$ of all T_0 objects, for $\mathcal{U}$ some class of embeddings. We say that the reflector **R** determines a $\mathcal{U}$-firm completion theory whenever $\mathcal{U}$ is the largest class of all morphisms u for which $\mathbf{R}(u)$ is an isomorphism.

For a metrically generated construct **X**, we describe a technique to lift an existing completeness notion in an auxiliary construct **A** to a suitable notion of completeness in **X** and we formulate conditions under which we can build a firm completion theory in the subconstruct $\mathbf{X}_0$ consisting of T_0 objects. Applying this technique to concrete cases results in many interesting completion theories and provides us with a far better understanding of several existing completion theories. An extra feature is that this study allows for applications to function spaces and sobrification.

<div align="center">

Nonparametric Regression Estimation:
an empirical process approach
to uniform-in-bandwidth consistency of kernel-type estimators and conditional U-statistics.
Julia Dony
May 19, 2008
Advisor: Uwe Eihnmahl

</div>

Nonparametric density and regression estimation has been the subject of intense investigation for many years and this has led to a large number of methods. One very well–known and commonly used class of estimators consists of the so–called *kernel–type estimators*, which are frequently used to estimate densities and regression functions. A typical kernel–type estimator based upon i.i.d. variables $(X_1, Y_1), \ldots, (X_n, Y_n)$ with values in $\mathbb{R}^d \times \mathbb{R}^r$ is defined as $\hat{\varphi}_{n,h}(t) = (nh^d)^{-1} \sum_{i=1}^{n} \varphi(Y_i) K((t - X_i)/h)$, where K is a kernel function, $0 < h < 1$ a bandwidth, and $\varphi : \mathbb{R}^r \to \mathbb{R}$ is a suitable measurable function.

Although there are basically no restrictions on the choice of the kernel, the choice of the bandwidth is more problematic, as it is responsible for an important bias–variance trade–off of the resulting kernel–type estimator. One thus has to find an appropriate bandwidth that would lead to an estimator having a good balance between bias and variance. Typically, the bandwidth that is most appropriate will vary according to the situation and will depend on the available data. This means that one can no longer investigate the behavior of such "optimal" estimators based upon data–dependent bandwidth sequences via the classical results for estimators based upon deterministic bandwidth sequences.

The main purpose of this thesis is to prove "uniform in bandwidth" results for a wide variety of kernel–type estimators, meaning that a supremum over suitable ranges of bandwidths is added to the original asymptotic result. This extra supremum permits to handle kernel–type estimators based upon bandwidths that are functions of the data. Our methodology relies mainly on the theory of empirical processes, and the basic tools are appropriate exponential deviation inequalities and moment inequalities for empirical processes. Throughout the different chapters we will apply this method several times to establish the uniform in bandwidth consistency of specific classes of kernel–type estimators and conditional U–statistics.

A first application of the method leads to a uniform consistency result for the kernel density estimator, where the standard supremum–norm is replaced by a weighted supremum–norm. Thereafter, the class of local

polynomial regression function estimators is handled, which are solutions of a weighted least–squares problem. In a third application, we focus on the pointwise consistency of kernel–type estimators (i.e. uniformly on a range of bandwidths, but for a fixed $t \in \mathbb{R}^d$) and improve it in such a way that our result applies to the kernel–based Hill estimator for the tail index of a Pareto–type distribution. As a last application of the method, we consider a much wider class of kernel–type estimators, called "conditional U–statistics".

Noetherian semigroup algebras and prime maximal orders
Isabel Goffa
25 April 2008, Mathematics,Vrije Universiteit Brussel
Advisor: Eric Jespers

Let S be a semigroup and K be a field. A K-space $K[S]$, with basis S and with multiplication extending, in a natural way, the operation on S, is called a semigroup algebra. It remains an open problem to characterize semigroup algebras that are a prime Noetherian maximal order.

In this thesis, we give an answer to the problem for a large class of cancellative semigroups and we illustrate these results with several examples of concrete classes of Noetherian maximal orders. Indeed, we find necessary and sufficient conditions for a prime Noetherian algebra $K[S]$ of a submonoid S of a polycyclic-by-finite group to be a maximal order. Under an invariance condition on the minimal primes, our result is entirely in terms of the monoid S and, in order to prove it, we describe the height one prime ideals of $K[S]$. Recall that it is conjectured that polycyclic-by-finite groups G are the only groups having a Noetherian group algebra and K.A. Brown characterized when these group algebras $K[G]$ are a prime Noetherian maximal order.

In case $K[S]$ also satisfies a polynomial identity, this means in case S is a submonoid of a finitely generated abelian-by-finite group, we show that the invariance condition on the minimal primes of S is necessary for $K[S]$ to be a prime Noetherian maximal order. Furthermore, we establish a general method for constructing non-abelian maximal order semigroup algebras of finitely generated submonoids of abelian-by-finite groups, starting from abelian maximal orders. To obtain concrete constructions, we thus also need to deal with abelian finitely presented monoids A. If A has a presentation with one or two defining relations, we determine necessary and sufficient conditions for $K[A]$ to be a domain that is a maximal order. The description is only in terms of the defining relations. Furthermore, we compute the class groups of such semigroup algebras.

In the appendix, we briefly explain applications of maximal orders in space-time coding. These applications softly point out that maximal orders not only might be interesting for experts in algebra, but also for specialists in coding theory.

KUL, PhD's

Maurice Duits, Spectra of large random matrices: asymptotic analysis of (bi)orthogonal polynomials and Toeplitz determinants
04.06.2008
Promotor: Arno Kuijlaars
http://www.kuleuven.ac.be/doctoraatsverdediging/cm/3E04/3E040878.htm

Lise Van Proeyen, Local zeta functions for ideals and the monodromy conjecture
03.07.2008
Promotor: Willem Veys
http://www.kuleuven.ac.be/doctoraatsverdediging/cm/3E04/3E041235.htm

Bilkis Jahanara, Symmetries in Riemannian geometry.
09.09.2008, 17h00
Promotor: Leopold Verstraelen
http://www.kuleuven.ac.be/doctoraatsverdediging/cm/3E07/3E071133.htm

5   Miscellaneous

5.1   From VUB

Ingrid Daubechies will be at VUB from 3 to 7 November 2008. Contact: pcara@vub.ac.be

5.2   News from IMO

The International Mathematical Olympiad (IMO) is the World Championship Mathematics Competition for High School students and is held annually in a different country. The first IMO was held in 1959 in Romania, with 7 countries participating. It has gradually expanded to over 90 countries from 5 continents.

This year, the 49th Mathematical Olympiad was held from July 10th to 22nd in Madrid, Spain. There were 535 participants from 97 countries. Belgium was represented by 6 young students (3 Flemish and 3 Walloon).

Here are the results for Belgium:

Ranking	Name	Final score
127	Nicolas Radu	22 Silver medal
238	Pierre-Alain Jacqmin	15 Bronze medal
268	Hoan-Phung Bui	14 Honourable mention
424	Daan Michiels	5 −
459	Mats Vermeeren	3 −
479	Dennis Presotto	2 −

The maximum score is 42 and you need respectively 31, 22 or 15 to earn a gold, silver or bronze medal. In order to receive a honourable mention, you have to get full marks on at least one of the problems.

This year 3 students got full marks on all questions. One American and two Chinese.

More details and the problems can be found at http://www.imo-2008.es/

5.3   News from the Francqui Foundation

An International Francqui Chair was awarded to the young Canadian Mathematician Erik Demaine (MIT). His inaugural lecture will be given on November 19, at the ULB (salle Dupréel, Sociologie), at 16h00. The title is "Mathematics meets Art, Puzzles, and Magic: Fun with Algorithms". The other lectures will be announced later.

More on Erik's mathematical interests can be found on http://erikdemaine.org/.

A drink will be served after this inaugural lecture.

Hugo Zaragoza (Yahoo! research, Barcelona)

Ranking text in search of knowledge and wealth

This is the 2008 Godeaux lecture

Search engines play a major role in the success and growth of the Web. In doing so they shape the web in all kinds of ways: creating new business models, modifying content creation practices, supporting new forms of user interaction, and magnifying ethical and social issues. But, at the core, search engines are incredibly fast ranking machines using relatively simple ranking algorithms. In the first part of my talk I will give an overview of the different "ranking problems" that search engines need to solve today, and the methods used to tackle them. One of the most crucial elements of search engines today is their ability to process the text in web pages to match future queries. In the second part of the talk I will concentrate in "text ranking" problems, from simple keyword based query retrieval problems, to more sophisticate problems where text is parsed and labeled semantically in the hope of constructing better ranking algorithms.

The Godeaux lecture is organized at least once every two years during a BMS event. These lectures honor the memory of Lucien Godeaux (1887-1975) who was one of the world's most prolific mathematicians (with 644 papers published) and took many initiatives to encourage young mathematicians to communicate their research. He was the founder of the Belgian Center for Mathematical Studies in 1949.

The proceedings will be published in the Bulletin of the Belgian Mathematical Society– Simon Stevin. Related papers are solicited. See symposium site.

Contact:

- Adhemar Bultheel
  (adhemar.bultheel@cs.kuleuven.be)
- Freddy Dumortier
  (freddy.dumortier@uhasselt.be)

Organization:

- The National Committee for Mathematics
- The Belgian Mathematical Society

Sponsor:

- Scientific Research Network Fundamental Methods and Techniques in Mathematics
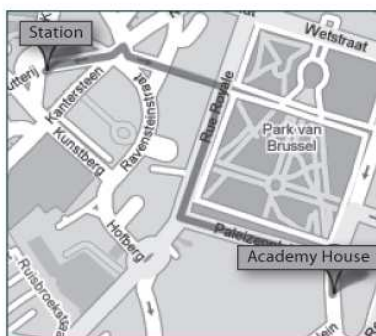
Registration:

Participation is free of charge, but registration is required for practical reasons. Please register before October 1, 2008 on

www.cs.kuleuven.be/conference/ranking/

Venue

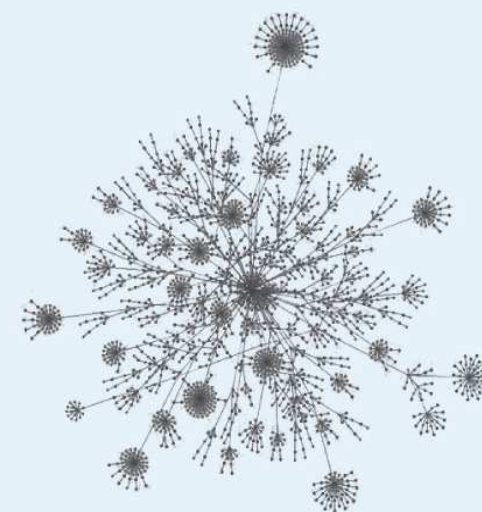Academy House, Hertogsstraat/Rue Ducale 1, Brussels

TRAIN:
Walk from Brussels Central Station

METRO:
Leave at 'Troon'

The Mathematics of Ranking

October 15, 2008

Academy House
Hertogsstraat/Rue Ducale 1
Brussels

www.cs.kuleuven.be/conference/ranking/

Program:

Abstracts

Bettina Berendt (K.U.Leuven)
Ranking - Use and Usability

The ultimate goal of ranking in search engines is to help people find what they are looking for - and (depending on the application) to suggest to them things that they didn't know they were looking for, but might still find interesting. Any evaluation of ranking methods should therefore consider such deployment scenarios. In this talk, an overview will be given of i) where and how ranking is used by the operators of a Web site or similar service, ii) how ranking is used by the end users of that site or service, and how such usage is measured, and iii) how and according to which criteria this usage and the success as well as the quality of ranking are measured.

Gianna M. Del Corso (Università di Pisa)
Evaluating scientific products by means of citation-based models

Some integrated models for ranking scientific publications together with authors and journals are presented and analyzed. The models rely on certain adiacency matrices obtained from the relations of citation, authorship and publication, which concur to forming a suitable irreducible stochastic matrix whose dominant eigenvector provides the ranking. Some perturbation theorems concerning the dominant eigenvector of nonnegative irreducible matrices are proved. These theoretical results provide a validation of the consistency and effectiveness of our models. Several paradigmatic examples are reported together with some results obtained on a real set of data.

Leo Egghe (Universiteit Hasselt)
Lotkaian informetrics and applications to social networks

Growth of the internet is illustrated as an example of 1-dimensional informetrics. Then we define 2-dimensional informetrics with sources and items leading to an Information Production Process (IPP) and examples are given. We introduce the notion of size-frequency function and of rank-frequency function. When the size-frequency function is a power law we say that the system satisfies the law of Lotka. Lotka's law is equivalent with the law of Zipf. Examples in websites are given. The scale-free

property of Lotkaian systems is highlighted and its consequence that Lotkaian IPPs can be interpreted as self-similar fractals is given, hereby illustrating the important role of the Lotkaian exponent.

Dynamic aspects of Lotkaian IPPs are given via the study of the effect of transformations on the sources and on the items. Transformation formulae are given for the size- and rank-frequency functions with applications. With the law of Lotka we can also give a model for the cumulative first-citation distribution and show practical applications.

We introduce the h-index and the g-index, give examples of their calculation on a ranked list of number of citations to papers and show their use in the evaluation of a scientist's career and of a meta-author. Advantages of the g-index above the h-index are given. When we have the law of Lotka we are able to present formulae for the h- and g-index. Using these formulae and the above described transformations, we are able to predict what will be the effect of "publicitis" on the value of the h-index. A website is shown where on can - in the context of Google Scholar - calculate the h-index, the g-index and other indices of an author.

Paul Van Dooren (UCL)
Some graph optimization problems in data mining

Graph-theoretic ideas have become very useful in understanding modern large-scale data mining techniques. We show in this talk that ideas from optimization are also quite useful to better understand the numerical behavior of the corresponding algorithms. We illustrate this claim by looking at two specific graph theoretic problems and their application in data mining. The first problem is that of reputation systems where the reputation of objects and voters on the web are estimated; the second problem is that of estimating the similarity of nodes of large graphs. These two problems are also illustrated using concrete applications in data mining.

Call for papers "The mathematics of Ranking"

Bulletin of the Belgian Mathematical Society – Simon Stevin

The mathematics of ranking is an emerging branch of mathematics. It has been given a boost with the success of Google. The gigantic eigenvalue problem that is solved there in order to rank web pages according to their "importance" is an example of mathematics that are applied in our daily lives.

This is just one aspect of how one should judge the "reputation", not only of a web site, or in data mining, but also of a (mathematical) discipline, of a research group, of a scientist, of a journal, or of a paper. How democratic are our voting systems? All important questions because it lies at the heart of politics, social systems, and for example strategic decisions of what (research) should be financed and what not. Is bibliometry or citation count a good tool to use in informetrics or scientometrics? Answers to these questions are of highest importance.

This involves challenges for computer scientists, but also opens new applications of mathematical disciplines such as linear algebra, graph theory, statistics, etc.

The Belgian Mathematical Society and the National Committee of Mathematics organizes a symposium on October 15, 2008 at the Royal Academy in Brussels entitled "The Mathematics of Ranking". It wants to bring together several expert lecturers who shall give an idea of the mathematics involved in answering several of these questions. The lectures should be accessible for a broad audience.

Lectures

- Hugo Zaragoza (Yahoo!research, Barcelona): *Ranking text in search of knowledge and wealth*

- Bettina Berendt (K.U.Leuven): *Ranking - Use and usability*

- Paul Van Dooren (UCL): *Some graph optimization problems in data mining*

- Leo Egghe (U. Hasselt): *Lotkaian informetrics and applications to social networks*

- Gianna M. Del Corso (U. Pisa): *Evaluating scientific products by means of citation-based models*

For more details see http://www.cs.kuleuven.be/conference/ranking/.

Proceedings of this symposium will be published as a special issue of the *Bulletin of the Belgian Mathematical Society – Simon Stevin*. Potential authors dealing with an aspect of this topic are invited to contribute to this issue. Submissions should be mailed to an editor of the journal mentioning the explicit intention to have it published in this special issue.

Le Groupe de contacts « Histoire comparée des sciences » du F.N.R.S.
Le Centre d'histoire des sciences et des technique de l'ULB (ALTAÏR)
Le Centre des Archives communistes en Belgique (CARCOB)

UNE JOURNEE SUR PAUL LIBOIS
Le samedi 10 octobre 2009, à l'ULB.
Première annonce.

Paul Libois (1906-1991) fut professeur à l'ULB et eut une importance concrète dans la
recherche en mathématiques : plusieurs de ses idées furent à l'origine de résultats et de
théories importantes. Parmi celles-ci la théorie des immeubles de Jacques Tits, Prix Abel
2008, qui est l'un de ses élèves. Il s'investit fort dans des questions de l'enseignement
mathématique. En particulier il eut des liens étroits avec l'Ecole Decroly à Bruxelles. Il fut
aussi connu pour son activité politique : après un rôle significatif dans la Résistance (seconde
guerre mondiale) , il devint un des principaux dirigeants du Parti Communiste de Belgique ,
jusqu'en 1954.
La réunion sera une occasion de fêter le vingtième anniversaire de la création d' ALTAÏR,
dont Libois fut un des promoteurs.

Le programme détaillé (local, heures, titres précis des exposés) sera diffusé en 2009, avant
les vacances d'été.
Programme non détaillé :
Franz Bingen (prof. émérite à la Vrije Universiteit Brussel) sur Paul Libois mathématicien,
Pierre-Emmanuel Caprace (IHES, Bures-sur-Yvette) sur la théorie des immeubles,
Simone Trompler (professeure retraitée à l'Ecole Decroly), sur Paul Libois et
l'enseignement mathématique,
José Gotovitch (prof. honoraire à l'Université Libre de Bruxelles) sur Paul Libois et le PCB.
Dans une Table Ronde : des témoins .

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