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AGENCIA ESTATAL DE INVESTIGACIÓN

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2017

Turno de acceso general

Nombre: ZWIERNIK , PIOTR
Referencia: RYC-2017-22544
Área Científica: Matemáticas
Correo Electrónico: piotr.zwiernik@upf.edu

Título:

Graphical models with latent variables: geometry and inference

Resumen de la Memoria:

My research is in mathematical statistics and it focuses on graphical models and other structured probabilistic models. In the curriculum part I briefly describe my past research. My current research focuses on total positivity and its links to graphical models including models with hidden variables. I am interested in links to deep learning theory and causality. The core part of my current research projects focuses on developing new tools to study the geometry of graphical models with hidden variables based on tensor algebra, and methods of obtaining guarantees for learning in non-convex regimes.

Graphical models became an important tool in the study of complex systems in many different applications. In this context a graph is given whose vertices represent random variables. The edges represent interactions between these variables. How exactly the edges represent interactions depends on a particular type of a graphical model.

My main objectives for the coming years are:

(O1): Analyze the geometry of graphical models with hidden variables.

(O2): Use these geometric insights to study existing inference methods. In particular, obtain guarantees for learning in high-dimensional settings.

(O3): Propose new inference procedures for structure learning that scale and work for a large family of distributional settings.

There are three main aspects that make my proposed project timely. First, the need for such studies has recently become more urging with the increased popularity of causal modeling, pattern recognition, deep learning and other areas using graphical models with latent variables. Second, algebraic geometers recently have started to systematically study latent graphical models from the algebraic perspective. Finally, high dimensional settings require a geometric understanding, which was successfully used in the Gaussian case.

The main aims of (O1) are is (i) to study identifiability of latent Bayesian networks, which is a completely open problem apart from the latent tree models case, and (ii) to obtain of the full semi-algebraic description for latent graphical models is another focus of (O1). It is a hard problem. For the causal analysis however, any progress in understanding the constraints will be important.

Objective (O2) is partly motivated by the techniques successfully applied to special latent graphical models like the single factor analysis model, latent class model, and latent tree models, where the underlying geometry gave a better insight into the underlying statistics. One of my motivations in Objective (O2) is to understand better the performance of the EM algorithm and other likelihood based algorithms.

In Objective (O3), I will primarily seek for an efficient and scalable method to do inference for latent graphical models. The idea of the relaxation of complicated problems is omnipotent in optimization and machine learning. Objective (O3) is also related with a new and exciting line of research in which graphical models are studied in the context of total positivity. I expect that for totally positive distributions very efficient methods exist that essentially mimic the Gaussian case.

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Resumen del Currículum Vitae:

Brief research description: In my research I use a variety of techniques from algebraic geometry, combinatorics, convex optimization, and theoretical statistics. I developed new combinatorial techniques to study latent tree models. This construction generalizes cumulants, central moments in statistics, as well as free and Boolean cumulants in free probability. I used these techniques to provide the full semialgebraic description of binary latent tree models and to study certain secant varieties in algebraic geometry. I was actively involved in the development of the singular learning theory, which is the study of empirical processes under non-standard assumptions. In addition, I have set foundations for linking latent variable models and positive dependence. I am generally interested in understanding the class of graphical models with latent variables.

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My publications: Over the last 6 years, I have published 17 scientific papers, all in high-impact peer-reviewed journals including 3 publications in Annals of Statistics, one in Journal of Royal Statistical Society - Series B and one in Journal of Machine Learning Research. I have completed two research monographs. The most recent one has been published by Chapman&Hall in their series Monographs on Statistics and Applied Probability. I have recently also contributed with a chapter to the forthcoming Handbook of Graphical Models, CRC Press (Editors: Mathias Drton, Steffen Lauritzen, Marloes Maathuis, Martin Wainwright).

Invited courses: I have given four invited lecture courses on my research. In 2018 I am going to give another lecture course as a part of the 38th Finnish Summer School on Probability and Statistics.

Editorial activities: I am an associate editor of Biometrika, Scandinavian Journal of Statistics, and Journal of Algebraic Statistics. The last two years I was on the program committee of ICML.

Organizational activities: I organized a big workshop in 2015 in Genoa and a monthly research program on Phylogenetics in the summer 2017 in Barcelona. I am now organising two meetings in 2018. I have organized several special sessions at big conferences. I have been also organizing research seminars, currently the Statistics and Operations Research seminar.

Competitive grants: I was a Marie Skłodowska-Curie International Outgoing Fellow (with University of California Berkeley and University of Genoa); the European Union s 7th Framework Programme grant PIOF- GA-2011-300975. This project finished in December 2015. Beginning from October 2017 I am holding the Beatriu de Pinós Fellowship, which is a 2-year award from the Catalan Agency for Management of University and Research Grants (82000 EUR).

Invited talks: Over the last 6 years I have given about 60 invited presentations (see my website for the list of all invited talks) and made 9 collaborative visits. Below I list of some of my invited presentations at internationally established conferences:
CMStatistics 2017 (Dec 2017), London,UK.
European Meeting of Statisticians 2017 (Jun 2017), Helsinki, Finland. CMStatistics 2016 (Dec 2016), Seville, Spain.
Joint Statistical Meetings 2016 (Aug 2016), Chicago, USA. CMStatistics 2015 (Dec 2015), London, UK
CMStatistics 2014, University of Pisa, Pisa, Italy
COMPSTAT 2014, Geneva, Switzerland.
Joint Statistical Meetings 2013, Montréal, Canada
MEGA 2011, Stockholm, Sweden

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Turno de acceso general

Nombre: BARROSO FREITAS, NUNO
Referencia: RYC-2017-22262
Área Científica: Matemáticas
Correo Electrónico: nunobfreitas@gmail.com

Título:

Diophantine Equations and Galois Representations

Resumen de la Memoria:

My research focus on the modular method to solve Diophantine equations. This method was born in the proof of Fermat's Last Theorem and was the greatest breakthrough on Diophantine equations of the last 25 years.
The idea, originally due to Frey, Serre, Ribet and Wiles is to attach to a putative solution of a (suitable) Diophantine equation an elliptic curve E (known as a Frey curve), and study the mod p representation attached to E via modularity and level lowering. This relates the solution to a modular form of weight 2 and small level. Then, by deriving a contradiction to this relation we conclude that the original solution does not exist.

In my work I have contributed to extend every step of the modular method. Along the way, I developed a large net of collaborators worldwide, including several of the greatest experts on Diophantine equations. Different main parts of my contributions were obtained with different sets of co-authors. This produced 14 papers and 4 preprints so far.

I now summarize the more substantial contributions, obtained on my own and in collaborations.

(1) Provided the first extension of the modular method to the setting of totally real fields and Hilbert modularity
(instead of modularity over Q) and succeeded in solving certain Fermat-type equations of the form x^r+y^r=Cz^p, where
r \geq 5 is a fixed prime and C is an integer. For this it was required proving new modularity results for elliptic curves over number fields, irreducibility results for Galois representations and computations with modular forms over number fields.

(2) Explored the extension described in (1) to study the Fermat equation x^p + y^p = z^p over totally real fields,
leading to the proof of asymptotic Fermat's Last Theorem for 5/6 of real quadratic fields. This required two major novelties: (i) the proof of modularity of all elliptic curves over real quadratic fields; (ii) a method using S-unit equations
to distinguish the mod p Galois representation attached to elliptic curves which can be applied uniformly across infinitely many fields.

(3) Studied the symplectic type of isomorphisms between the p-torsion of elliptic curves, leading to new ways to distinguish Galois representations. More precisely, we have obtained a complete list of local symplectic criteria
at primes different from p. The criteria are easy to apply from the standard invariants Delta, c_4, c_6
of the curves. As a consequence, we obtained several new Diophantine results, including some on the challenging Fermat equations x^3 + y^3 = z^p and x^2 + y^3 = z^p.

(4) Developed a criterion for the irreducibility of the mod~p Galois representations of certain abelian varieties of
GL_2-type. Used it to improve a case left open by Darmon on his program for the Generalized Fermat equation.
Further, we extended the multi-Frey technique over totally real fields leading to new Diophantine results, including a complete resolution of the Fermat equations x^r + y^r = 3z^n for r=5,13 and n >= 2 an integer.
For this, and in order to obtain the final contradiction, we extended the `image of inertia argument' to the setting of abelian surfaces.

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Resumen del Currículum Vitae:

I did my undergraduate and master studies at the Instituto Superior Técnico, where I was awarded twice the prize Novos Talentos em Matemática, which recognizes the top undergraduates in Portugal.

After I applied for a Portugese PhD grant and studied Number Theory at the University of Barcelona. My supervisor, Luis Dieulefait set me the project of investigating Diophantine equations of the form x^r+y^r=C z^p. This provided me with a route to learn the modular method, i.e. the strategy that proved Fermat's Last Theorem, which combines elliptic curves, modular forms and Galois representations. In my thesis I extended this strategy to the setting of Hilbert modular forms which introduced a new level of flexibility. I was awarded my PhD in October 2012 and received the Premi Extraordinari 2012--2013.

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I followed with a visit to Fred Diamond (King's College London) to learn more about modularity lifting to extend the modular method. I also visited Samir Siksek (Warwick) and we started a collaboration on applying ideas from my thesis to the Fermat equation over real quadratic fields. To prove general results we needed modularity of elliptic curves over these fields. We started to work on this problem and somewhat later we learned that Bao Le Hung (Harvard) was also working on this and we invited him to join us as a collaborator. Together we proved that all elliptic curves over real quadratic fields are modular. Following this, Siksek and myself completed our work on the Fermat equation, proving in particular an asymptotic version of Fermat's Last Theorem for 5/6 of real quadratic fields. For these works I was distinguished with the Prize José Luis Rubio de Francia 2014 y el Proyecto Jose Luis Rubio de Francia 2015.

After 3 months in London, I was almost 3 years in Germany, at the University of Bayreuth and the Max-Planck institute (Bonn). Alongside with my work with Siksek, I started working with Michael Stoll (Bayreuth) and Bartosz Naskrcki (Bristol) on the equation x^2+y^3=z^p. It is through this work that I learned the importance of symplectic criteria within the modular method and made my first contribution to that subject. This led me to initiate a collaboration with Alain Kraus (Paris 6) where we recently obtained a full generalization of the symplectic ideas and several new Diophantine applications.

In February 2016 I started a postdoctoral fellowship with Michael Bennett at the University of British Columbia (Vancouver) who is an expert on a analytical approach to Diophantine equations. Together using a combination of analytical tools with symplectic criteria we successfully solved new families of Fermat-type equations. Furthermore, while in Vancouver I have also started productive collaboration with Imin Chen (Simon Fraser University), Nicolas Billerey (Clermont-Ferrand) and Dieulefait (Barcelona) with the objective of extending the modular method to include abelian varieties.

I recently obtained a Marie-Curie fellowship to spend two years at the University of Warwick staring on March 2018.

My work so far produced 14 papers and 4 preprints. Along the way, I developed a large net of collaborators worldwide, including several of the greatest experts on Diophantine equations. Different main parts of my contributions were obtained with different sets of co-authors.

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CONVOCATORIA 2017

Turno de acceso general

Nombre: DOMINGUEZ VAZQUEZ, MIGUEL
Referencia: RYC-2017-22490
Área Científica: Matemáticas
Correo Electrónico: miguel.dominguez@icmat.es

Título:

Symmetry in Riemannian submanifold geometry

Resumen de la Memoria:

My research revolves around the mathematical notion of symmetry in submanifold theory. The interest in this topic can be traced back to the influential work of Élie Cartan around one century ago. The interplay between Riemannian geometry, Lie group theory and geometric analysis is, therefore, the central axis of my research.

On the one hand, I have been interested in the classification of certain types of isometric actions, such as cohomogeneity one actions or, more generally, polar actions, whose study has shown to be powerful in the construction of geometric structures or in the understanding of the geometry of symmetric spaces. Specifically, I have classified polar actions on complex hyperbolic spaces and deepened into the study of cohomogeneity one actions on symmetric spaces of noncompact type.

On the other hand, I have investigated the characterization of the orbits of isometric actions (the so-called homogeneous submanifolds) by geometric criteria. This led me to the notion of isoparametric hypersurface and its generalizations. Roughly, my work has shown that inhomogeneous isoparametric submanifolds are much more common than the homogeneous ones, even in spaces with a large isometry group. In particular, my results include the first examples of inhomogeneous isoparametric hypersurfaces in symmetric spaces of noncompact type, the classification of isoparametric hypersurfaces in complex hyperbolic spaces (the first such complete classification after Segre□s and Cartan□s works in the 30s), and the first examples of inhomogeneous isoparametric foliations of codimension higher than one on a compact symmetric space (including an intriguing relation to prime numbers).

More recently, motivated by certain connections between the theories of isoparametric hypersurfaces and overdetermined boundary problems of PDEs, I have been working in the construction of solutions to overdetermined boundary problems associated with a wide range of nonlinear elliptic equations in very general Riemannian manifolds, providing also some of the first known symmetry results in harmonic and symmetric spaces of nonconstant curvature.
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Resumen del Currículum Vitae:

Born in Ourense (Spain) in 1985, I graduated in Mathematics at the University of Santiago de Compostela in 2008, with National Award. I did my doctoral studies with an FPU fellowship at the same university under the advisorship of José Carlos Díaz Ramos. I got my PhD in March 2013 with an European thesis in differential geometry, obtaining the highest qualification and Extraordinary PhD Award.

After a short postdoctoral stay at King's College London in spring 2013, I obtained an excellence grant from IMPA (Rio de Janeiro), where I worked for more than two years. In 2016 I joined the ICMAT (Madrid) with a Juan de la Cierva fellowship. In 2017 I was awarded a two-year Marie Sklodowska-Curie Individual Fellowship by the European Commission. I held this grant at ICMAT from April to September 2017 and then I took up a position of Profesor Ayudante Doctor at the Department of Mathematics of the Universidad Autónoma de Madrid, where I worked from September 2017 to January 2018. In mid January 2018 I suspended this position at the university and resumed the Marie Sklodowska-Curie fellowship at ICMAT, where I am currently working.

My research focuses on the interaction between the mathematical notion of symmetry and Riemannian submanifold theory. Specifically, I have been interested in the investigation of isometric actions, isoparametric submanifolds, submanifolds of symmetric spaces, and overdetermined boundary value problems.

Since my first paper in 2011, I have been author of 14 articles and 5 book chapters, both in collaboration and independently. My research has given rise to publications in journals such as Adv. Math. (2 papers), Trans. Amer. Math. Soc., Math. Z. (2 papers), Indiana Univ. Math. J. and Int. Math. Res. Not. (IMRN). I have presented my research in more than 40 conferences, seminars or minicourses, 30 of them as invited or plenary speaker, in countries such as United Kingdom, Germany, Japan, Korea, Argentina and Brazil. I have done research stays at the Universities of Cologne and São Paulo, among others. I have participated in 10 research projects, including two European ones. I have refereed more than 20 papers for around 15 international journals, reviewed more than 20 publications for AMS Reviews, co-organized several scientific events, and participated in two PhD thesis committees.

I co-advised the PhD thesis of Cristina Vidal Castiñeira, which was defended in 2016 deserving the highest mark and the international

doctorate distinction, and giving rise to 4 JCR publications in journals such as J. Geom. Anal. and Ann. Mat. Pura Appl. I am currently co-advising the PhD theses of Víctor Sanmartín López and Olga Pérez Barral. The defense of the former is scheduled for 2018 and has already given rise to 3 publications (one of them in Adv. Math.), whereas the latter is expected for 2021. I have also co-advised a Master thesis, supervised two advanced undergraduate research projects at the Severo Ochoa Initiation to Research Program of the ICMAT, and two stays of PhD students at IMPA.

Also, I have experience in the popularization of science to different publics, including secondary school students and researchers of other sciences. I have taught more than 350 hours in different centers, including the official PhD course of Riemannian Geometry at IMPA, and with an average students satisfaction of 4.8 out of 5.

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CONVOCATORIA 2017

Turno de acceso general

Nombre: KNAUER , KOLJA
Referencia: RYC-2017-22701
Área Científica: Matemáticas
Correo Electrónico: kolja.knauer@gmail.com

Título:

Interactions of Combinatorics and Geometry

Resumen de la Memoria:

My area of research lies in the interaction of Discrete and Combinatorial Geometry with Graph Theory and the theory of Oriented Matroids and Lattices. I will say, that also outside of the following main themes of my research I have a broad horizon of work. One of my strengths as a researcher is my versatility and my ability to get deep into new topics an produce relevant results quickly. In this sense: other results of mine are in planar graphs, graphs on surfaces, digraph coloring, graph decomposition, (lattice path) matroids, partial cubes, and even pizza sharing are accessible on my page http://pageperso.lif.univ-mrs.fr/~kolja.knauer/. Among others I have answered questions and conjectures of Barat & Thomassen, Fukuda, Golumbic, Harutyunyan, Hochstättler, Saks & West, and Winkler.

Main lines of research:
On the one side I have been working on Oriented Matroids and their generalizations, as well as their combinatorial and graphical representations and algorithmic aspects. Here one main ingredient is the combinatorial understanding and enconding of topolgically or geometrically complex situation. This is my first research topic (Oriented matroids and beyond).
At the basis of the second line of research one considers the combinatorial and geometric structure of large sets of combinatorial objects, such as orientations of a graphs or tilings of a region. (Lattices and polyhedra on combinatorial objects).
On the other hand I have always been interested in geometric combinatorics in the plane and in 3-space. Many of my works concern geometric intersection graphs, graph drawing and geometric hypergraphs. These topics are part of my third line of research (Low dimensional combinatorics).
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Resumen del Currículum Vitae:

I have a permanent position as Associate professor at Aix-Marseille Université.

During my undergraduate studies I received a competitive 1 year study exchange grant (Jahresstipendien für Studierende aller wissenschaftlichen Fächer) from the German academic exchange service (DAAD) in one of the leading math research institutes of México. I completed my PhD thesis in Mathematics with highest distinction under Stefan Felsner at TU Berlin in 2010, funded by the graduate school Methods for Discrete Structures (MDS) of the German Science Foundation (DFG). I did postdoctoral research stays in Berlin (1,5 year - funded by the European Science Foundation (ESF)) and Montpellier (1,75 year - funded by two different projects of the Agence Nationale de Recherche (ANR)).
My research is in Graph Theory and its connections to areas such as Discrete and Combinatorial Geometry, Oriented Matroids, and Lattices. My interest lies in the interaction of theses areas and benefits from an algorithmic point of view. I am a mathematician with an eye for problems of theoretical computer science and my research generates a mutual benefit for both areas.
I have co-authored one book and published 28 journal papers in top journals of combinatorics including JCTA, COMBINATORICA, Discr. Comput. Geometry, and SIAM Jounral Disc. Math.. I have 17 publications in conference proceedings, including SODA which is a top 3 conference in general theoretical computer science. Furthermore, 7 papers of mine are submitted. My publications have been cited about 260/91 times and my h-index is 10/6 (GoogleScholar/Scopus).

In 2015, I received a PEPS research grant from CNRS with me was the Principal Investigator. I am member of three projects of the ANR totalling an amount of about 800000. I have been postdoctoral researcher in other ANR projects and one international project funded by the ESF. Already in my undergraduate studies I successfully applied for a one year exchange grant from DAAD, then a three years PhD grant from the DFG, and a PhD scholarship from the internationally connected MDS. See point 2 below for details.

I am an experienced advisor: 1 postdoc, 2 PhD students (one finishes soon, one in her second year), 3 Master theses, 2 Bachelor's theses, and 5 research internships on different levels of study. Furthermore, I am member of a PhD committee (Washington D.C).

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CONVOCATORIA 2017

Turno de acceso general

Nombre: SARDAÑES CAYUELA, JOSE
Referencia: RYC-2017-22243
Área Científica: Matemáticas
Correo Electrónico: josep.sardanyes@gmail.com

Título:

Sistemas Dinámicos No Lineales y Bifurcaciones en Biomedicina

Resumen de la Memoria:

Mis campos de investigación son los Sistemas Dinaámicos No Lineales y la Biología Matemática. A lo largo del 2004-2009 completé un master y una tesis doctoral (calificación: Excelente cum laude) en sistemas dinámicos biológicos bajo la supervisión del Dr Ricard Solé; (Complex Systems Lab, Universidad Pompeu Fabra, UPF). Publiqué 16 artículos de investigación en revistas internacionales y 2 capítulos de libro. Trabajé en modelos matemáticos basados en ecuaciones diferenciales ordinarias no lineales, en bifurcaciones, y en modelos de simulación estocástica en sistemas de replicadores como los virus de ARN. Mi tesis fue premiada en dos ocasiones.
Durante 2009-2011 realicé un postdoc en el Instituto de Biología Molecular y Celular de Plantas (CSIC, grupo dirigido por el Professor Santiago F. Elena), publicando 15 artículos en revistas internacionales y 1 capítulo de un libro. La línea principal de investigación fue la modelización matemática y el estudio de la dinámica evolutiva de virus en plantas transgénicas que codifican microARNs artificiales para el silenciamento de genes virales. Paralelamente también iniciamos una nueva línea de investigación matemática sobre el modo de replicación de virus de ARN y las bifurcaciones en su dinámica y evolución, línea que actualmente seguimos desarrollando. Estas dos líneas fueron abordadas mediante trabajo experimental y teórico-matemático. En el periodo 2011-2012 hice un segundo postdoc en University of California San Francisco (UCSF, United States of America), trabajando en el virus de immunodeficiencia humana desarrollando y analizando modelos matemáticos multi-escala de partículas interferentes con el virus. Como resultado de mi trabajo publicamos en Trends in Biotechnology (factor de impacto 11.96). Al finalizar el postdoc en Estados Unidos me reincorporé como postdoc en el Complex Systems Lab (UPF) durante 2012-2016. Trabajé en sistemas dinámicos y no linealidad en evolución del cancer y en modelos de estabilidad genética en virus. Mi trabajo en estos cuatro años se ha traducido en 16 artículos en revistas científicas internacionales de matemáticas, física y biología matemática, y en un 1 capítulo de libro.
En Enero de 2017 empecé un cuarto postdoc en el un centro de investigación de matemáticas (Centre de Recerca Matemática, Campus de Bellaterra) y como miembro de la Barcelona Graduate School of Mathematics, gracias a la obtención de una beca competitiva de la fundación "la caixa" en el área de matemáticas. Mis objetivos principales a medio/largo plazo son la caracterización de bifurcaciones responsables de cambios dinámicos adaptativos de células tumorales bajo terapia responsables de la extinción o regresión tumoral. Estamos abordando este problema abierto, mediante la teoría de los sistemas dinámicos conjuntamente con datos experimentales disponibles en el grupo. El objetivo es la caracterización de escenarios de parámetros favorables a la regresión tumoral. Dentro de esta línea de investigación hemos descubierto una nueva bifurcación global, la bifurcación trans-heteroclínica. Esta bifurcación es causada por el intercambio de estabilidad entre dos puntos fijos que no colisionan, a diferencia de la bifurcación transcrítica.
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Resumen del Currículum Vitae:

Número de publicaciones: 58 (52 artículos científicos + 4 capítulos de libro + 2 artículos de divulgación)
Número de artículos de investigación como primer autor: 28
Número de artículos de investigación como último autor: 19
Número de publicaciones como único autor: 4 artículos de investigación + 1 capítulo de libro
Número de artículos de investigación como "corresponding author": 30
Número de artículos de investigación en revistas del Q1: 46
índice h: 13
índice i10: 22
Sumatorio factor de impacto = 128
Número de citas totales: 566
Trienios de investigación: Primer trienio (2013), segundo trienio (2016)

Premios:
1. Premio extraordinario a la tesis doctoral (año 2009) concedido por la Comisión de doctorado y postgrado de la Universitat Pompeu Fabra.
2. Premio a la transferencia de conocimiento de la tesis doctoral, otorgado por el Consejo Social de la Universitat Pompeu Fabra.

Obtención de becas competitivas:
1. Beca postdoctoral Juan de la Cierva 2010

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2. Beca postdoctoral "Training Program in Collaborative Mathematical Research" otorgada por "la caixa Foundation" (duración anual, termina Diciembre 2018)
Experiencia en gestión y dirección de trabajos a estudiantes de grado, de master, y de doctorado:

Tesis dirigidas:
1. Título: Topological and Dynamical Complexity in Epidemiological and Ecological Dynamical Systems. Carla Cristina Morbey Rodrigues (licenciada en Matemáticas, Universidade de Évora, Portugal). Calificación Sobresaliente cum Laude. Año 2017.
Producto de ésta tesis hemos publicado 4 artículos de investigación en revistas internacionales:
Numerical Algorithms (2018) In press
Acta Biotheoretica 63(4): 341-361 (2015)
Applied Mathematics and Computation 252: 484-495 (2015)
International Journal of Bifurcations and Chaos. 23: 1350124 (2013)

Trabajos de fin de Master dirigidos:
1. Dynamics and transitions in symmetric hypercycles: the role of the hypercycle size (estudiante de Matemáticas: Gerard Farré). Facultat de Matemàtiques i Estadística (FME), Universitat de Barcelona. Año 2016. Publicado en la revista Nonlinear Dynamics 90(3): 1873-1883 (2017)
2. Peto's paradox: Modeling evolutinoary dynamics of cancer defenses (estudiante de Matemáticas: Paula Subías). Universitat Pompeu Fabra. Año 2016

Trabajos de fin de Grado dirigidos:
1. Nonlinear Dynamics of replication modes in tunable deleterious fitness landscapes (estudiante de Matemáticas: Joan Fornés). Universitat Politècnica de Catalunya. Año 2017. Trabajo en revisión en la revista Journal of Theoretical Biology.
2. Exploring the error threshold through a Poincaré Compactification (estudiante de Matemáticas: Raquel Colomer Armenteris). Universitat de Barcelona. Año 2017.
3. Oscillating hypercycles at the origins of life: A bifurcation analysis (estudiante de Matemáticas: Júlia Puig Lescure). Universitat Politècnica de Catalunya. Año 2016. Publicado en la revista International Journal of Bifurcation and Chaos (2018) In press.
4. Dynamics and bifurcations in a simple quasispecies model of tumorigenesis (estudiante de Matemáticas: Vanessa Castillo). Universitat Politècnica de Catalunya. Año 2014. Publicado en la revista Computational and Applied Mathematics 36: 415-431 (2017)