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# German Hernández

## Current Position

### **Associate Professor.**

Department of Computer Engineering, National University of Colombia, Bogota, Colombia. My teaching duties include graduate courses of evolutionary computing and applications, analysis of algorithms and advanced topics in algorithms. Occasionally, I teach Java programming, probabilistic models in computing and numerical analysis at undergraduate level.

## Education

**Postdoctoral Research.** CERI – Center for Earthquake Research and Information, US Geological Service and University of Memphis, TN, USA. Summer 2000. Focused on developing non-linear and stochastic dynamical models for earthquake faults using genetic algorithms.

**Ph.D. Mathematics with concentration in Computer Science,** 2000. Doctoral Dissertation: “Asymptotic behavior of evolutionary algorithms”. The University of Memphis, TN, USA.

**M.Sc. Mathematics with concentration in Computer Science,** 1999. Thesis: “An evolutionary algorithm binary images matching”. The University of Memphis, TN, USA.

**M.Sc. Statistics,** 2004. M.Sc. Thesis: “Modeling generic genetic algorithms as iterated random functions”. National University of Colombia, Bogota, Colombia.

**M.Sc. Mathematics,** 1996. Mention of Merit in the M.Sc. Thesis: “Categorical semantics for languages oriented by objects with non-deterministic behavior”. National University of Colombia, Bogota, Colombia.

**B.Sc. Computer Systems Engineering,** 1990. National University of Colombia, Bogota, Colombia.

## Research Interests

The use of random dynamical systems (stochastic processes, iterated random maps, iterated function systems, stochastic differential equations, hidden Markov models and Markov decision processes) to model and analyze: evolutionary algorithms, randomized algorithms, randomized distributed algorithms, communications networks, stochastic agents, neural networks and artificial immune systems. Also the applications evolutionary algorithms, randomized algorithms, stochastic agents, neural networks and artificial immune systems in management of supercomputing grids, bioinformatics, financial engineering and image processing.

## Experience

**Academic Director.** Bogotá Branch., National University of Colombia. 2005-2006.  
**Academic ViceDean.** College of Engineering, National University of Colombia. 2004-2005.

**Assistant Professor.** Dept. of Comp. Eng., Nat. Univ. of Colombia, Bogota. 1996-2001. I was on leave from Aug. 1997 until Jul. 2001 to complete a Ph.D. program.

**Research Assistant.** CERI – Center for Earthquake Research and Information, The University of Memphis, TN, USA. Summer 1999. Responsible for updating software for the continuous GPS based geodetic reference network in the Central US. This includes UNIX based geodetic

software and software for data acquisition from 12 GPS stations in the New Madrid fault.

**Teaching Assistant.** Math. Sci. Dept, The University of Memphis, TN, USA. Fall 1997 – spring 2000. Taught undergraduate courses of Computer Literacy, Computer Programming and tutored for the graduate course of Models of Computation.

**Instructor.** (full-time). Dept. of Comp. Eng, Nat. Univ. of Colombia, Bogota. 1992-1996. Taught numerical methods, simulation, and theory of computation.

**Instructor** (part-time). Dept. of Math. and Stat., Nat. Univ. of Colombia Bogota. 1991-1992. Taught calculus and differential equations.

**Software Engineer.** Camaleon Animation e Informatics, Bogota. 1990-1991. Member of a team that developed CARAMBA, an animation software system on Silicon Graphics platforms. This software package was also ported to Windows and sold to Intergraph, AL, USA.

### Professional Activities

**Associations:** AMS, IEEE, Phi Kappa Phi Honor Society, European Network of Excellence in Evolutionary Computing.-EvoNet., Colombian Mathematical Society, Colombian Operations Research Society (SOCIO).

Presided Number Theory session, South-eastern Sectional Meeting of the Mathematical Association of America (MAA), Rhodes College TN, March 1999.

Chaired Object Orientation session, World Multiconference on Systemics, Cybernetics and Informatics No. III, Orlando FL, August 1999.

Referee for Intelligent Engineering Systems through Artificial Neural Networks, Vol 10. C.H. Dagli et al (eds) ASME press, 2000.

Graduate Studies Coordinator, Department of Computer Engineering and Computer Science. National University of Colombia, Bogota, 2000.

Referee for the 2002 Congress on Evolutionary Computation at the 2002 World Congress on Computational Intelligence to be held in Honolulu, Hawaii May 12-17, 2002.

Academic Co-chair of the Colombian Seminar on Stochastic Processes and Their Applications 2002 to be held as part of the 12th Symposium of Statistics at the National University of Colombia - Bogotá, August 14th -18th, 2002.

Member of the academic committee of the I Andean Meeting - II Colombian Congress in Operations Research - Colombian Soc. of Oper. Research and U. Javeriana, Bogota September 2002.

Referee for Systems, Man and Cybernetics - Part B - 2002.

Member of Committee for Computer Engineering Graduate Examination ECAES -2003

### Selected Talks

*“Evolutionary Set Matching”* and *“Texture Segmentation with a Cascade Correlation Neural Network using Markov Random Fields”* in ANNIE 98: Artificial Neural Networks in Engineering, St. Louis, MO., November, 1998.

*“Stochastic Differential Models for Evolutionary Algorithms”* in the AMS National Meeting, Probability and Statistics session, San Antonio, January 1999.

*“On Massive Interconnection Graphs”* in 30<sup>th</sup> SE International Conference on Combinatorics, Graph Theory, and Computing: Florida Atlantic University, Boca Raton FL, March 1999.

*“Stochastic differential models for evolutionary algorithms over continuous spaces”* in Genetic and Evol. Comp. Conference GECCO'99, Orlando, FL, 1999.

*“Ergodicity in evolutionary systems”* in the World Multiconference on Systemics, Cybernetics and Informatics, Orlando, FL, 1999.

*“Financial Time Series Modelling using Evolutionary Trained Random Iterated Neural Networks”* in Computational Intelligence for Financial Engineering, New York, March 2000.

*“Convergence of Evolutionary Algorithms”* Colombian Congress of Mathematics, Bogotá , August, 2000

*“Equilibrium States of Iterated Random Maps Arising in Evolutionary Algorithms”* in Frontiers of Evolutionary Algorithms, Atlantic City, NJ, May 2000.

*“Stochastic Dynamic Programming: Overview and Applications”* Seminar on New Technologies in Optimization. Colombian Soc. of Oper. Research, Bogotá, March, 2001

*“Evolutionary Training of Hidden Markov Models with Fixed Number of States”* Congress of the Colombian Soc. of Oper. Research, Medellín, September, 2001.

*“Experimental Analysis of Convergence in Evolutionary Algorithms”*. In Proceedings of Iberoamerican Conference on Computational Mathematics. Bogota, 2001.

*“An Overview of Statistical Learning Theory”*. XIV Simposio Nacional de Estadística, Cartagena, Colombia 2004.

## References

Dipankar Dasgupta. Research Associate Professor (Doctoral Diss. Advisor)  
Department of Mathematical Sciences-Computer Science Division  
The University of Memphis  
[dasgupta@msci.memphis.edu](mailto:dasgupta@msci.memphis.edu)

Kenneth Wilder,  
Senior Lecturer,  
Department of Statistics and the College  
The University of Chicago  
[wilder@finmath.uchicago.edu](mailto:wilder@finmath.uchicago.edu)

Giri Narasimhan. Associate Professor.  
Computer Science Department  
Florida International University  
[giri@cs.fiu.edu](mailto:giri@cs.fiu.edu)

Luis Fernando Niño, Associate Professor  
Department of Computer Engineering.  
National University of Colombia  
[lfminov@unal.edu.co](mailto:lfminov@unal.edu.co)

Robert Smalley Jr. Research Associate Professor  
CERI: Center for Earthquake Research and Information.  
The University of Memphis  
[smalley@ceri.memphis.edu](mailto:smalley@ceri.memphis.edu)

Jerome Goldstein, Professor  
Department of Mathematical Sciences  
The University of Memphis  
[goldstej@msci.memphis.edu](mailto:goldstej@msci.memphis.edu)

## Publications

J. García, G. Hernández and J.C. Galeano. Cooperation, Solution Concepts and Long-term Dynamics in the Iterated Prisoner's Dilemma, In the proceedings of the Congress on Evolutionary Computation (CEC), IEEE Press, Vancouver, CA.,2006.

D.F. Delgado, D.F. Vidal, G. Hernández. Evolutionary Design of Pseudorandom Sequence Generators based on Cellular Automata and its applicability in current Cryptosystems. In Proceedings of the Genetic and Evolutionary Computation Conference, GECCO-2006, ACM Press. 2006

G. Hernandez, L. Bobadilla and O. Sanchez. A Genetic Word Clustering Algorithm In the proceedings of the Congress on Evolutionary Computation (CEC), IEEE Press, Edinburg, Scotland, UK.,2005.

G. Hernandez, K. Wilder, F. Niño and J. Garcia., Towards a Self-Stopping Evolutionary Algorithm using Coupling from the Past. In Proceedings of the Genetic and Evolutionary Computation Conference, GECCO-2005, ACM Press. 2005

- G. Hernandez, F. Nino, J. Garcia, D. Dasgupta. On Geometric and Statistical Properties of the Attractors of a Generic Evolutionary Algorithms, In the proceedings of the Congress on Evolutionary Computation (CEC), IEEE Press, Portland, Oregon, USA.2004.
- G. Hernandez, F. Amaya y F. Davila. Algoritmo Genético para la Clasificación de las Palabras de un Corpus (Spanish), Memorias del XIV Simposio Nacional de Estadística, Cartagena, Colombia 2004.
- G. Hernandez and J.C. Montoya., Experimental Analysis of Convergence in Evolutionary Algorithms. In Proceedings of CIAMAC, Eds. L.G. Torres et al. Thompson Pub. Co, 2001.
- G. Hernandez, F. Nino, Y. Garcia and K. Khouri. Stochastic Matching Agents. In Proceedings of the AROB 2001: Artificial Life and Robotics Conference, Oita, Japan Jan. 2001.
- D. Dasgupta, G. Hernandez and F. Nino. An Evolutionary Algorithm for Fractal Coding of Binary Images. In IEEE Transactions on Evolutionary Computation, Vol 4, No. 2, Pag. 172-181 July 2000.
- F. Nino, G.Hernandez and A. Parra. Financial Time Series Modelling using Evolutionary Trained Random Iterated Neural Networks. In Proceedings of CIFER, 2000, March 26-28, New York.
- G.Hernandez, A. Quas, F. Nino and D. Dasgupta. Equilibrium States of Random Iterated Random Maps Arising in Evolutionary Algorithms. In Proceedings of ISIC 2000 and FEA 2000 (Frontiers of Evolutionary Algorithms) Atlantic City, NJ, May 2000.
- F. Nino, F. Botelho, G. Hernandez and A. Quas, Random iterated neural networks as dynamical systems universal approximators, In Proceedings of the AROB 2000: Artificial Life and Robotics Conference, Oita, Japan Jan. 2000.
- F. Nino, G.Hernandez and D. Dasgupta. Evolutionary Design of Random Iterated Neural Networks. In Intelligent Engineering Systems through Artificial Neural Networks, Vol 9. C.H. Dagli et al (eds) ASME press, 1999.
- G.Hernandez, F. Nino, F. Botelho and A. Quas. Random Iterated Neural Networks: Asymptotic Behavior. In Intelligent Engineering Systems through Artificial Neural Networks, Vol 9. C.H. Dagli et al (eds) ASME press, 1999.
- G. Hernandez, J.A. Goldstein and F. Niño Stochastic differential models for evolutionary algorithms over continuous spaces. In Proceedings of Genetic and Evolutionary Computation Conference GECCO'99, Vol. 1, Ed. Wolfgang Banzhaf et al., page 863, Morgan Kauffman Publisher, San Francisco CA, 1999..
- G. Hernandez, F. Niño ,and R. De Castro. On dynamical systems arising in nondeterministic object oriented programs. In Proceedings of the World Multiconference on Systemics, Cybernetics and Informatics No. III, Vol. 1, Ed. Nagib Callos et al., page 226, Publications of the International Institute of Informatics and Systemics, Orlando, Fl, 1999.
- G. Hernandez, F. Niño ,and A. Quas. Ergodicity in evolutionary systems. In Proceedings of the World Multiconference on Systemics, Cybernetics and Informatics No. III, Vol. 3, Ed. Nagib Callos et al. page 148, Publications of the International Institute of Informatics and Systemics, Oralndo, Fl, 1999.
- F. Niño , G. Hernandez and F. Bothelo. Associative Storage of information using n-dimensional dynamical systems. In Proceedings of the World Multiconference on Systemics, Cybernetics and Informatics No. III, Vol. 2, page 322, Publications of the International Institute of Informatics and Systemics, Florida, 1999.
- F. Niño, G. Hernandez and D. Dasgupta. On evolution of stochastic dynamical neural networks (poster). In Proceedings of Genetic and Evolutionary Computation Conference GECCO'99, Vol. 1, Ed. Wolfgang Banzhaf et al., page 801, Morgan Kauffman Publisher, San Francisco CA, 1999.

G. Hernandez and F. Niño. Stochastic differential models for genetic algorithms. In Abstracts of the Papers Presented to the American Mathematical Society Vol. 20, No. 1, page 134,1999.

G. Hernandez, G. Narasimhan and F. Niño. Evolutionary set matching. In Smart Engineering Systems: Neural Networks, Fuzzy Logic, Evolutionary Programming, and Rough Sets Vol. 8 . C.H. Dagli et al (eds) ASME press, 1998.

G. Hernandez and D. Dasgupta. Texture segmentation with a cascade correlation neural network using Markov random fields. In Smart Engineering Systems: Neural Networks, Fuzzy Logic, Evolutionary Programming, and Rough Sets Vol. 8. C.H. Dagli et al (eds) ASME press,1998 .

G. Hernández, J.J. Martínez L.F. Niño and L.G. Torres (Eds). Memories of First National Congress of Neurocomputation( Spanish), Colombian Academy of Natural, Physics and Exact Sciences, Collection Carlos Lleras, Bogota, Colombia, 1996.

G. Hernández, L.F. Niño. Complex systems control theory (Spanish). in Memories of First National Congress of Neurocomputation), Colombian Academy of Natural, Physics and Exact Sciences, Collection Carlos Lleras, Bogota, Colombia, 1996.

G. Hernández, L.F. Niño and L.G. Torres. Fundamentals of neurocomputaion (Spanish). Ingeniería e Investigación No 1. 1995.

G. Hernández, L.G. Torres Stochastic cellular automata. (Spanish) Lect. Mat. Vol 15, no. 2, 167-191.1994.

L.G. Torres, G. Hernández and L.F. Niño. Neural Networks(Spanish). Mem. of Tutorial, X Colloquium of Mathematics and Statistics. Bogota, Colombia. 1993.

### Grants

National University. Bogota, Colombia. — Research Grant for the Project: Evolutionary Training of Hidden Markov Models.

National University. Bogota, Colombia. — Research Grant for the Project: UnGrid developing a distributed supercomputer using the local network at UN Bogota.

Rocky Mountain Mathematics Consortium — Grant to attend the Graduate Summer School on Probabilistic Combinatorics at the University of Wyoming, Laramie, WY, June 2000.

University of Utah – NSF Grant to attend Stochastics 2000 (Seminar on Stochastic Processes, 2000) at the University of Utah, Salt Lake City, UT. March 2000.

IEEE- grant award to attend the Conference on Computational Intelligence for Financial Engineering, New York, NY, March 2000.

The University of Memphis – Student Government Association award to attend GECCO 99, Orlando FL, June 1999.

The University of Memphis – Student Government Association award to attend ISIC 2000 and FEA (Frontiers of Evolutionary Algorithms) Atlantic City, NJ, May 2000.

Faculty Research Award, School of Engineering, National University of Colombia,1993.

### **BSc. Honors Thesis Advising**

Vallejo and Lopez L.R. Indexing Image Data Bases. 1993  
Arturo O.S. and Romero M.J. Image Distortion Correction using Associative Memories 1994  
Vargaz E.M. Interactive Software Tool for Fractal Image Compression. 1996  
Carvajal O. and Ayala. A. Image Animation based on 2D-Dynamics. 1996.  
Moreno A. And Orduz J.E. Texture Classification with Multilayer Recurrent Neural Networks 1996  
Bohorquez C.L: And Camargo I.A. Automata Network Simulator. 1997.  
Chavarriga J.E. and Chica J.A. Interactive Software Tool for Chaotic Dynamics Visualisation 1997.  
Montoya J.C. Speed of Convergence in Generic Genetic Algorithms, 2001.  
Vidal D. and Montoya. D. Evolutionary based Cellular Automata Based Pseudorandom Generators, 2004

### **MSc. Thesis Advising**

Martinez, M., Evolutionary Training of Hidden Markov Models, 2002.  
Davila F., A Comparison between Ney and Genetic Algorithms for Stochastic Grammar Generation, 2004.  
Salas R., Evolutionary Training of Markov Decision Processes. (in progress)  
Filogenetic Tree Search using Genetic Algorithms (in progress)  
Agudelo O.A Traffic Model for the UN-Bogotá Campus Communications Network (in progress)

### **Former Students**

Andres Parra, Ph.D. student at the Florida International University FI, USA.  
Oscar Vallejo, working for Brickwell Corp, Miami, FL.  
Orlando Carvajal, presently graduate student at the University of Waterloo, ON, CA.  
Jaime Chica, presently graduate student at the Georgia Institute of Technology; Atlanta, GA.  
Jaime Niño, presently graduate student at the University of Birsbane, Australia.  
Edgar Vargas, Instructor, Comp. Eng and comp. Sci. Dept. National University of Colombia, Bogota.  
Jose Carlos Aranda, computer specialist at J.D. Edwards and graduate student at the U. Colorado at Denver  
Fabio Gonzalez, PhD. student at the U. of Memphis; Memphis, TN.  
Jonathan Gomez, PhD. student at the U. of Memphis; Memphis, TN.  
German Florez, graduate student at Mississippi State U., Starkville, MI.  
Miguel Torres, graduate student at Mississippi State U., Starkville, MI.  
Leandro Cortés, Ph.D. student at U of Chicago., Chicago, IL.  
Carlos Rojas Ph.D. student at the U. of Memphis; Memphis, TN.  
Cesar Cardona Ph.D. student at the U. of Memphis; Memphis, TN.  
Wilson Castro, PhD. student at the U. Kaiserslautern, Germany.  
David Moreno graduate student at the Technische Universiteit Eindhoven, Nethererlands(Holland)  
Cesar Acuña graduate student at the Technische Universiteit Eindhoven, Nethererlands(Holland)

### **Technical Skills**

Programming (primary): JAVA, HTML, JavaScript, C++. (secondary): Parallaxis, C, Fortran, Pascal, Modula, Basic, Bash Shell, Csh Shell, Mathematica, MatLab, Zeus Agent Building Toolkit, Graphical applications using LEDA, GDK and QT on Linux.

I have also experience installing, configuring and programming heterogeneous PC Unix based parallel clusters using PVM (Parallel Virtual Machine) and MPI (Message Passing Interface)  
Operating systems: Windows, Unix (Linux, Solaris, Ultrix, AIX), Mac OS.  
Hardware: Intel based PC's, Silicon Graphics, Sun SPARC, IBM SP.