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Summary

I received an education in Physics, Biology, and Imaging in Psychiatry. Since my graduate school years, I have been interested in diverse aspects of theoretical biology, including Brownian transport, molecular computation, spike reliability in neurons, song production and representation in songbirds, statistics of natural images and visual perception, statistics of natural language, and brain imaging. After joining IBM Research, I have been working on computational approaches to brain function, with an emphasis on mathematical models to describe high dimensional data and to identify markers of complex mental disorders. More recently, I have developed novel approaches to characterize perception and cognition analytically, utilizing the increasing availability of big data on human behavior. In particular, I spearheaded the application of computational linguistics to short speech samples for diagnosis and prognosis of conditions as diverse as schizophrenia, mania, drug and alcohol intoxication, Alzheimer's Disease, Parkinson's disease and chronic pain.

Personal

Citizen of Argentina.

Citizen of the United States.

Education

M.Sc. Physics, University of La Plata, Argentina, 1991.

Ph.D. Physics and Biology, The Rockefeller University, 1994-1999.

Employment

Principal Research Staff Member and Manager, IBM T.J. Watson Research Center, IBM Research, 2015 to date.

Research Staff Member, IBM T.J. Watson Research Center, IBM Research, 2001 to 2015.

Physics Postdoctoral Associate, Functional Neuroimaging Laboratory, Psychiatry Department, Cornell University Medical College, 2000.

Postdoctoral Associate, Norman and Rosita Winston Fellow, Laboratory of Mathematical Physics, Center for Physics and Biology, The Rockefeller University, 1999.

Current Appointments

Director, Computational Psychiatry and Neuroimaging, IBM Research

Lead, Predictive Analytics and Interventions, Worldwide Adaptive Health Initiative, IBM Research

Associate Director, Analytics Core, NIH Advanced Medicines Partnership on Schizophrenia

Publications

Over 150 peer-reviewed publications in journals and conference proceedings, including Science, PNAS, The Lancet, Phys. Rev. Lett., Neuron, World Psychiatry, J. Neurosci., NIPS, AISTATS, AAAI, IJCAI, Nature Communications and Nature Schizophrenia, 20 patents and 2 edited books, with 6,000+ citations; h-index=38, i10-index=77 (Google Scholar as of 02/2021).

Selected Publications

Quantitative language features identify placebo responders in chronic back pain. *Pain* (2021)

Identifying signals associated with psychiatric illness utilizing language and images posted to Facebook. *npj Schizophrenia* (2020)

Linguistic markers predict onset of Alzheimer's Disease. *The Lancet eClinicalMedicine* (2020)

Loss of nucleus accumbens low-frequency fluctuations is a signature of chronic pain. *Proc. Natl. Acad. Sci. USA* (2020).

Resting-state connectivity stratifies premanifest Huntington's Disease decline. *Scientific Reports* (2020).

Prediction of natural language descriptions of odorant perception. *Nature Communications* (2018).

Brain and psychological determinants of placebo pill response in chronic pain patients. *Nature Communications* (2018).

Prediction of psychosis across protocols and risk cohorts using automated language analysis. *World Psychiatry* (2018).

Reverse-engineering human olfactory perception from chemical features of odor molecules. *Science* (2017).

Automated Analysis of Free Speech Predicts Psychosis Onset in High-Risk Youths. *npj Schizophrenia* (2015).

A Window into the Intoxicated Mind? Speech as an Index of Psychoactive Drug Effects. *Neuropsychopharmacology* (2014).

The perceptual basis of evolving Western music styles. *Proc. Natl. Acad. Sci. USA* (2013).

Predictive dynamics of human pain perception. *PLoS Comp Bio* (2012).

Self-tuned critical anti-hebbian networks. *Physical Review Letters* (2009).

Prediction and Interpretation of Distributed Neural Activity with Sparse Models. *Neuroimage* (2009).

Ordered cyclic motifs contribute to the dynamic stability of biological and engineered network. *Proc. Nat. Acad. Sci. USA* (2008).

Scale-free brain functional networks. *Physical Review Letters* (2005).

Global properties of the Wordnet lexicon. *Proc. Nat. Acad. Sci. USA* (2002).

Simple motor gestures for birdsong. *Physical Review Letters* (2001).

On a common circle: natural scenes and Gestalt rules. *Proc. Nat. Acad. Sci. USA* (2001).

Toward a Song Code: Syllabic Representation in the Canary Brain. *Neuron* (1998).

Recent Press Coverage

New York Times (2021)

New York Times Magazine (2021)

Scientific American, USA Today, BBC World Service (2020)

The Scientist (2019)

Wall Street Journal (2018)

Engadget, Futurism (2018)

The New Yorker (2017)

Current Collaborations

Boston Scientific: predictive analytics for chronic pain management (**co-PI**).

NIH AMP Schizophrenia: predictive analytics in prodromal schizophrenia(**co-PI**)

Cure Huntington's Disease Initiative (CHDI): neuroimaging analytics and imaging-based biomarkers (**PI**).

Cure Huntington's Disease Initiative (CHDI): speech-based markers of early onset in HD (**PI**).

Answer ALS: speech-based markers of ALS progression (**co-PI**).

Mt Sinai School of Medicine: automated speech diagnosis of psychiatric disorders (**co-PI**).

University of Alberta: speech analytics in PTSD (**consultant**).