

Curriculum Vitae

Professor Khadiga Ali Arwini

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Personal Details

Date of Birth: 7 May 1974

Sex: Female

Marital Status: Married

Nationality: Libyan

Education

- 2001-2004 Department of Mathematics, The University of Manchester, Manchester-UK; PhD thesis: **Differential geometry in neighbourhoods of randomness and independence.**
- 1996-1998 Department of Mathematics, Al-Fateh University; Tripoli-Libya; MSc thesis: **Dense topology.**

Research

My MSc thesis concerned separation properties in general topology—under the supervision of Professor Hassan Alzagdani. For my PhD research I concentrated on the geometry and topology of smoothly parametrized function spaces of probability density functions—information geometry—under the supervision of Professor C.T.J. Dodson. The main results in my thesis may be summarised as follows

- The system of linear connections, its universal connection and curvature on the gamma 2-manifold and the Gaussian 2-manifold.
- The α -geometry, including affine immersions, of the McKay bivariate gamma 3-manifold, the Freund bivariate exponential 4-manifold and the bivariate Gaussian 5-manifold.
- The geometry of three submanifolds of the McKay bivariate gamma 3-manifold, illustrating how curvature depends on correlation.
- The geometry of four submanifolds of the Freund bivariate exponential 4-manifold, including the important special case of independent bivariate exponential processes.
- Comparison of distance measures for discriminating between bivariate stochastic processes with positive covariance and gamma marginal distributions: Fisher information, Bhattacharyya distance and Kullback-Leibler divergence. Applications arise in tomography of hydrological soil surveys.
- Representations in $\mathbb{R}^3$ of information geometric tubular neighbourhoods containing all bivariate processes sufficiently close to the independent bivariate exponential process with identical marginals. This result has wide application in the theory of stochastic processes because exponential processes are in bijective correspondence with Poisson processes which model the random state and provide good limiting models for binomial processes.

- Representations in $\mathbb{R}^3$ of information geometric tubular neighbourhoods containing all bivariate processes sufficiently close to the independent bivariate Gaussian process with both marginals $N(0, \sigma)$. The Central Limit Theorem makes our neighbourhoods of independence limiting cases for a wide range of bivariate processes; the topological character of the result makes them stable under small perturbations, which is important for applications.

The above results have included also collaborations with several visiting professors at UMIST: **Professor J. Scharcanski**, Department of Informatics, Federal University, Porto Alegre, Brasil; **Dr H. Matsuzoe**, Department of Mathematics, Saga University, Saga, Japan; **Dr L. Del Riego**, Department of Mathematics, San Luis Potosi University, San Luis Potosi, Mexico. All of these collaborations are continuing and they have led to research papers.

Book

1. Khadiga Arwini and C.T.J. Dodson. Information Geometry Near Randomness and Near Independence. Lecture Notes in Mathematics 1953, **Springer-Verlag**, Berlin, Heidelberg, New York 2008.

Research publications in differential geometry

1. Khadiga Arwini. The Geometrical Structures of Bivariate Gamma-Exponential Distributions. **World Scientific News**. WSN (143), (2020) 181-200.
2. Khadiga Arwini. Information Geometry of Frechet Distributions. **World Scientific News**. WSN (144), (2020) 296-312.
3. Khadiga Ali Arwini. Gumbel Manifold. **The Third Conference on Mathematical Sciences, CMS'2011**. Zarqa University-Jordan, 27 - 29 April 2011.
4. Khadiga Ali Arwini and C.T.J. Dodson. Alpha Geometry of the Weibull Manifold. **The Second Basic Sciences Conference**. Tripoli-Libya, November 4-8,2007.
5. Khadiga Arwini, L. Del Riego and C.T.J. Dodson. Local Finsler Geometry Arising from Gamma Distribution Statistical Manifolds. **Seventh International Joint Meeting AMS-SMM**. Zatecas, Mexico, May 23-26,2007.
6. Khadiga Arwini, L. Del Riego and C.T.J. Dodson. Universal connection and curvature for statistical manifold geometry. **Houston Journal of Mathematics**, 33, 1 (2007) 145-161.
<http://www.maths.manchester.ac.uk/kd/PREPRINTS/univconexpf.pdf>
7. Khadiga Arwini and C.T.J. Dodson. Neighbourhoods of independence and associated geometry. **Central European Journal of Mathematics** 5,1 (2007) 50-83 .
<http://www.maths.manchester.ac.uk/kd/PREPRINTS/nhdindep.pdf>
8. Khadiga Arwini and C.T.J. Dodson. Neighbourhoods of Independence for Random Processes via Information Geometry. **The Mathematica Journal** 9;4-2005, **Wolfram Media, Inc** (2005).
9. Khadiga Arwini, L. Del Riego and C.T.J. Dodson. Universal connection and curvature for statistical manifold geometry. **American Mathematical Society and Mexican Mathematical Society Joint Meeting**. Houston, 12-15 May 2004. *Abstracts American Mathematical Society*, March 2004.
<http://www.ma.umist.ac.uk/kd/PREPRINTS/univconexpf.pdf>
10. Khadiga Arwini and C.T.J. Dodson. Information geometric neighbourhoods of randomness and geometry of the McKay bivariate gamma 3-manifold. **Sankhya: Indian Journal of Statistics** 66, 2 (2004) 211-231. <http://www.ma.umist.ac.uk/kd/PREPRINTS/gamran.pdf>.
11. Khadiga Arwini, C.T.J. Dodson and Hiroshi Matsuzoe. Alpha connections and affine embedding of McKay bivariate gamma 3-manifold. **Internat. J. Pure Appl. Math.** 9, 2 (2003) 253-262.
<http://www.ma.umist.ac.uk/kd/PREPRINTS/affmckay.pdf>

12. Khadiga Arwini and C.T.J. Dodson. Neighbourhoods of randomness and information geometry of the McKay bivariate gamma 3-manifold. In Proc. **International Mathematica Symposium 2003** Imperial College Press, London 2003 pp. 247-254.
<http://www.ma.umist.ac.uk/kd/PREPRINTS/IMS.nb>

Research publications in topology

1. Khadiga Arwini and Entisar Laghah. λ -Generalizations and g-Generalizations. **Tarbawe Journal-Elmergib University**. Vol (19), (2021) 245-255.
2. Nagah Elbhilil and Khadiga Arwini. Axioms of Countability Via Preopen Sets. **World Scientific News**. WSN (152), (2021) 111-125.
3. Amel Kornas and Khadiga Arwini. R-Countability Axioms. **World Scientific News**. WSN (142), (2020) 92-109.
4. Khadiga Arwini and Amel Kornas. D-Countability Axioms. **World Scientific News**. WSN (143), (2020) 28-38.
5. Khadiga Arwini and Mabrouk Almargni. Separation Axioms Weaker Than T_1 . **World Scientific News**. WSN (144), (2020) 158-168.
6. Khadiga Arwini and Hanan Saad. New Pairwise Separation Axioms in Bitopological Spaces. **World Scientific News**. WSN (145), (2020) 31-45.

Preprints

1. Khadiga Arwini and Amel Kornas. On δ -Sequential Spaces. Submitted.
2. Khadiga Arwini and Huda Mira. SD-Lindelof Spaces. Preprint.
3. Khadiga Arwini and Hana Garamanli. Further Properties on Somewhere Dense Sets. Preprint
4. Khadiga Arwini, C.T.J. Dodson, S. Felipussi and J. Scharcanski. Comparison of distance measures between bivariate gamma processes. Preprint.
<http://www.ma.umist.ac.uk/kd/PREPRINTS/hydrology.pdf>

Presentations at research meetings

1. The Second Basic Sciences Conference, 5 November 2007, The Al-Fateh University, Tripoli-Libya : *Information Geometry*
2. The Second Basic Sciences Conference, 5 November 2007, The Al-Fateh University, Tripoli-Libya : *Alpha Geometry of the Weibull Manifold*
3. Information Geometry Workshop, Kyushu University, Kyushu-Japan, 23 July 2004: *Information geometry of the Mckay bivariate gamma manifold*
4. Information Geometry Workshop, RIKEN Brain Science Institute, Tokyo-Japan, 22 July 2004: *Mckay bivariate gamma manifold and hydrology*
5. Information Geometry Workshop, Hokkaido University, Sapporo-Japan, 21 July 2004: *Neighbourhoods of randomness, independence and uniformity and associated geometry*
6. International Mathematica Symposium, July 2003, Imperial College, London-UK: *Neighbourhoods of randomness and information geometry of the McKay bivariate gamma 3-manifold*

Teaching experience

- 2017-2019: Lecturer in Mathematics, Tripoli University, Tripoli-Libya.
- 2016-2017: Lecturer in Mathematics, Al-Zawia University, Zawia-Libya.
- 2005-2015: Lecturer in Mathematics, Tripoli University, Tripoli-Libya.
- 2005-2007: Lecturer in Mathematics, part-time, Al-Mergab University, Al-Koumes-Libya.
- 2002-2004: Tutorial Assistant, part-time, Department of Mathematics, The University of Manchester, Manchester-UK
- 1998-2001: Lecturer in Mathematics, Al-Fateh University, Tripoli-Libya.
- 1995-1998: Assistant Lecturer in Mathematics, Al-Fateh University, Tripoli-Libya.

Courses taught

Undergraduate Courses: Differential Geometry, General Topology, Set Theory, Linear Algebra and Calculus.

Postgraduate Courses: Differential Geometry, Topology, Linear Algebra and Computer Packages.

Computer skills

Computer algebra with *Mathematica*, scientific wordprocessing with $\text{\LaTeX}$.