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SCIENTIFIC PUBLICATIONS

A Generalization of the Pearson Correlation to Riemannian Manifolds

Role: Author, Affiliation: Universität Heidelberg; Mathematisches Institut

Subjects: Statistics Theory (math.ST); Differential Geometry (math.DG), MSC classes: 62H20

Publication date of current revision (Rev. 3): 7 Mai 2020, Date of latest review: 20 June 2020

Abstract: The increasing application of deep-learning is accompanied by a shift towards highly non-linear statistical models. In terms of their geometry it is natural to identify these models with Riemannian manifolds. The further analysis of the statistical models therefore raises the issue of a correlation measure, that in the cutting planes of the tangent spaces equals the respective Pearson correlation and extends to a correlation measure that is normalized with respect to the underlying manifold. In this purpose the article reconstitutes elementary properties of the Pearson correlation to successively derive a linear generalization to multiple dimensions and thereupon a nonlinear generalization to principal manifolds, termed Riemann-Pearson Correlation

URI: https://arxiv.org/abs/2006.04215

Applications of Structural Statistics: Geometrical Inference in Exponential Families

Role: Author, Affiliation: Universität Heidelberg; Mathematisches Institut

Subjects: Statistics Theory (math.ST), MSC classes: 62G07

Publication date of current revision (Rev. 2): 19 April 2020, Date of latest review: 20 June 2020

Abstract: Exponential families comprise a broad class of statistical models and parametric families like normal distributions, binomial distributions, gamma distributions or exponential distributions. Thereby the formal representation of its probability distributions induces a confined intrinsic structure, which appears to be that of a dually flat statistical manifold. Conversely it can be shown, that any dually flat statistical manifold, which is given by a regular Bregman divergence uniquely induced a regular exponential family, such that exponential families may - with some restrictions - be regarded as a universal representation of dually flat statistical manifolds. This article reviews the pioneering work of Shun'ichi Amari about the intrinsic structure of exponential families in terms of structural statistics.

URI: https://arxiv.org/abs/2004.08909

Foundations of Structural Statistics: Statistical Manifolds

Role: Author, Affiliation: Universität Heidelberg; Mathematisches Institut

Subjects: Statistics Theory (math.ST); Information Theory (cs.IT), MSC classes: 62A01

Publication date of current revision (Rev. 2): 18 Feb 2020, Date of latest review: 20 June 2020

Abstract: Upon a consistent topological statistical theory the application of structural statistics requires a quantification of the proximity structure of model spaces. An important tool to study these structures are Pseudo-Riemannian metrices, which in the category of statistical models are induced by statistical divergences. The present article extends the notation of topological statistical models by a differential structure to statistical manifolds and introduces the differential geometric foundations to study distribution families by their differential-, Riemannian- and symplectic geometry.

URI: https://arxiv.org/abs/2002.07424

Foundations of Structural Statistics: Topological Statistical Theory

Role: Author, Affiliation: Universität Heidelberg; Mathematisches Institut

Subjects: Statistics Theory (math.ST); Machine Learning (cs.LG), MSC classes: 62A01

Publication date of current revision (Rev. 3): 21 December 2019, Date of latest review: 20 June 2020

Abstract: Topological statistical theory provides the foundation for a modern mathematical reformulation of classical statistical theory: Structural Statistics emphasizes the structural assumptions that accompany distribution families and the set of structure preserving transformations between them, given by their statistical morphisms. The resulting language is designed to integrate complicated structured model spaces like deep-learning models and to close the gap to topology and differential geometry. To preserve the compatibility to classical statistics the language comprises corresponding concepts for standard information criteria like sufficiency and completeness.

URI: https://arxiv.org/abs/1912.10266

Principal Manifold Based Correlation Analysis applied to Gene Regulation Analysis

Role: Author, Affiliation: Universität Heidelberg, Deutsches Krebsforschungszentrum (DKFZ)

Subjects: Machine Learning (cs.LG); Gene Regulation (q-bio.MN), MSC classes: 62A01

Publication date: 1 September 2017

Abstract: Gene regulation analysis is a challenging task, which requires the consideration of intricate dependency structures. These structures, however, frequently are only selectively understood in terms of parametric relationships, which also impedes the derivation of meaningful correlation measures. The present thesis addresses this issue by introducing a generalized correlation measure, which is based on principal manifolds. This is motivated by recent advances within the approximation of principal manifolds by deep structured Energy Base Models. Finally, the application of this approach is demonstrated for gene regulation analysis of cDNA microarray data of Glioblastoma Multiforme.

URI: https://t.ly/1pwj

TALKS AT SCIENTIFIC CONFERENCES

Structure Learning with deep neural networks revisited

Event: 7th Network Modeling Workshop 2014, Heidelberg, Germany

Role: Speaker, Affiliation: Deutsches Krebsforschungszentrum (DKFZ)

Subjects: Gene Regulation (q-bio.MN); Machine Learning (cs.LG), MSC classes: 62A01

Date of talk: 28 February 2014

URI: https://www.slideshare.net/PatrickMichl1/structure-learning-with-deep-neuronal-networks-218824948

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Structure Learning with deep neural networks

Event: 6th Network Modeling Workshop 2013, Jena, Germany

Role: Speaker, Affiliation: Deutsches Krebsforschungszentrum (DKFZ)

Subjects: Gene Regulation (q-bio.MN); Machine Learning (cs.LG), MSC classes: 62A01

Date of talk: 6 June 2013

URI: https://www.slideshare.net/PatrickMichl1/structure-learning-with-deep-neuronal-networks-2013-218824204

Structure learning with Deep Autoencoders

Event: Network Modeling in Systems Biology 2013, Heidelberg, Germany

Role: Speaker, Affiliation: Deutsches Krebsforschungszentrum (DKFZ)

Subjects: Gene Regulation (q-bio.MN); Machine Learning (cs.LG), MSC classes: 62A01

Date of talk: 30 April 2013

URI: https://www.slideshare.net/PatrickMichl1/structure-learning-with-deep-autoencoders

Regulation Analysis using Restricted Boltzmann Machines

Event: 5th Network Modeling Workshop 2013, Heidelberg, Germany

Role: Speaker, Affiliation: Deutsches Krebsforschungszentrum (DKFZ)

Subjects: Gene Regulation (q-bio.MN); Machine Learning (cs.LG), MSC classes: 62A01

Date of talk: 10 January 2013

URI: https://www.slideshare.net/PatrickMichl1/regulation-analysis-using-restricted-boltzmann-machines-218822661

Concept of Regulation Analysis using restricted Boltzmann Machines

Event: iBIOS 2012, Kleinwalsertal, Austria

Role: Speaker, Affiliation: Deutsches Krebsforschungszentrum (DKFZ)

Subjects: Gene Regulation (q-bio.MN); Machine Learning (cs.LG), MSC classes: 62A01

Date of talk: 2 February 2012

URI: https://www.slideshare.net/PatrickMichl1/concept-of-regulation-analysis-using-restricted-boltzmann-machines-218821777

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TALKS AT EXPERT CONFERENCES

Attention please! Attention Mechanism in Neural Networks

Event: 4th PyData Conference 2019, Heidelberg, Germany

Role: Speaker, Affiliation: frootlab.org

Subjects: Machine Learning (cs.LG), MSC classes: 62A01

Date of talk: 21 November 2019

URI: https://www.slideshare.net/PatrickMichl1/attention-please-attention-mechanism-in-neural-networks-218825708

Anwendungen nichtlinearer Korrelationsanalyse in der Open Source Analyse (OSINT)

Event: Corporate Workshop, Pullach im Isartal, Germany

Role: Speaker, Affiliation: External / Freelance Data Scientist

Subjects: Machine Learning (cs.LG), MSC classes: 62A01

Date of talk: 8 June 2019

BOOKS

Netzwerktechnik

Description: Textbook for the vocational education of IT- and electrical engineers.

Role: Author, Affiliation: Bayerische Industrie- und Handelskammer

Publisher: Fernlehrinstitut Dr. Robert Eckert GmbH

Article: NET(TE)1, ArtNo 02303

Publication date: 1 August 2011