

PROCEEDINGS OF SPIE

**2021 International Conference
on Statistics, Applied Mathematics,
and Computing Science
(CSAMCS 2021)**

**Hong-Ming Yin
Ke Chen
Romeo Meštrović
Teresa A. Oliveira**
Editors

**26–28 November 2021
Nanjing, China**

Organized by
Nanjing University (China)

Sponsored by
AEIC Academic Exchange Information Center (China)

Published by
SPIE

Volume 12163
Part One of Two Parts

Proceedings of SPIE 0277-786X, V. 12163

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *International Conference on Statistics, Applied Mathematics, and Computing Science (CSAMCS 2021)*, edited by Hong-Ming Yin, Ke Chen, Romeo Meštrović, Teresa A. Oliveira, Proc. of SPIE 12163, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510652026

ISBN: 9781510652033 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2022 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL
LIBRARY**

SPIEDigitalLibrary.org

Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

Part One	STATISTICAL NUMERICAL ANALYSIS AND MULTIVARIATE STATISTICAL DECISION
12163 02	Research on the statistical analysis methods of heart disease: taking the Framingham Heart Study as an example [12163-163]
12163 03	Statistical analysis of employee retention [12163-199]
12163 04	Multivariate analysis on determining the main influencing factors of police violence in the United States [12163-129]
12163 05	A research on measuring the development level of agriculture and tourism in Anhui Province based on multivariate statistical analysis [12163-50]
12163 06	Comparison of bio-statistics software platform: SAS, SPSS, and R language [12163-155]
12163 07	Applying multiple linear regression and quadratic curve fitting to predict Beijing's housing prices [12163-198]
12163 08	Comprehensive evaluation of pumped hydro storage based on a combined method of improved sequence relation analysis and entropy [12163-9]
12163 09	Analysis on investment performance and influencing factors of farmland water conservancy infrastructure in various regions of China based on SFA method [12163-131]
12163 0A	Influencing factors and the path to realization of carbon balance in China: analysis using statistical models [12163-99]
12163 0B	A numerical method for solving the problem of particle motion in non-inertial system [12163-85]
12163 0C	Regression analysis of correlation between learning time and academic performance [12163-227]
12163 0D	Statistical analysis of several factors in predicting student performance [12163-166]
12163 0E	Numerical study on permeability and mechanical property of pervious concrete [12163-78]
12163 0F	Predicting Google Play Store Apps installations with linear regression and XGBoost [12163-183]
12163 0G	Linear programming's application in routine choice of goods transportation from Guangzhou to Washington [12163-212]
12163 0H	Nonexistence of Brouwer's fixed-point theorem in one-dimensional constructive analysis [12163-217]

- 12163 0I **Analysis of life expectancy** [12163-162]
- 12163 0J **MFTIWPSO based support vector regression method and its application on supply chain management** [12163-5]
- 12163 0K **A highway investment risk assessment method based on extreme learning machine** [12163-30]
- 12163 0L **Cross-sectional study of association between social support, job strain and cardiovascular disease** [12163-182]
- 12163 0M **Analysis of health resource allocation in 11 cities in Jiangxi based on the rank sum ratio** [12163-58]
- 12163 0N **Simple random walk and Pólya's recurrence theorem** [12163-146]
- 12163 0O **Stability analysis of visual servo system based on image Jacobian matrix** [12163-66]
- 12163 0P **A numerical study on Leland's strategy** [12163-91]
- 12163 0Q **Degrees of freedom analysis of parallel mechanisms based on screw theory** [12163-94]
- 12163 0R **Association between air pollution, low birth weight and prematurity** [12163-225]
- 12163 0S **Cox regression analysis on the survival rate of breast cancer patients** [12163-197]
- 12163 0T **Analysis and research on the economic model of supply-side reform in Anshan** [12163-108]
- 12163 0U **Evolutionary game analysis and simulation of technology diffusion for green agriculture** [12163-211]
- 12163 0V **Statistical investigation on association between the cumulative number of fully vaccinated people in the U.S. and the daily Covid-19 confirmation cases** [12163-196]
- 12163 0W **Statistical investigation on potential triggering factors of acute liver failure** [12163-142]
- 12163 0X **Analysis on the change law and influencing factors of atmospheric particulate matter concentration in Xiamen city** [12163-125]
- 12163 0Y **Air quality survey and analysis: a study in Nansha District from 2016 to 2020** [12163-8]
- 12163 0Z **Evaluating factors for sustainable design of products in the apparel industry using DANP technique** [12163-6]
- 12163 10 **Analysis of ambient air quality in Xi'an during the thirteenth five-year plan period** [12163-68]
- 12163 11 **Correlation between microplastics estimation and human development index** [12163-34]

- 12163 12 **Analysis and research on the cost of power grid technological transformation projects based on linear regression analysis method** [12163-243]
- 12163 13 **Research on cloud computing in power system** [12163-75]
- 12163 14 **How CVD is affected by work control, demand, and support: a study of Swedish working population using effect modifier** [12163-177]
- 12163 15 **Study on the influence mechanism of ecological consumption behavior: taking Beijing citizens as an example** [12163-31]
- 12163 16 **Reservoir water temperature numerical simulation** [12163-241]
- 12163 17 **Prediction of carbon emission based on energy consumption structure by statistical forecasting** [12163-236]

APPLIED MATHEMATICS AND ALGORITHM MODEL PREDICTION OPTIMIZATION

- 12163 18 **The physical model of the existence time of water droplets in the air** [12163-2]
- 12163 19 **A model can describe large networks** [12163-3]
- 12163 1A **Modelling of train load induced vibration of track-tunnel-unsaturated soil system** [12163-60]
- 12163 1B **Analyzing network architecture models based on applications** [12163-113]
- 12163 1C **A discussion about the dependence of stock-market price and the deviation of individual stock** [12163-164]
- 12163 1D **Site percolation simulation and percolation threshold** [12163-135]
- 12163 1E **Synchronization of fractional-order Bhalekar-Gejji systems via adaptive backstepping sliding mode control** [12163-93]
- 12163 1F **Decision tree: basic theory, algorithm formulation and implementation** [12163-147]
- 12163 1G **Arrangement method of parking spaces in underground garages based on improved genetic algorithm** [12163-237]
- 12163 1H **Design and analysis of a special digital signature scheme** [12163-231]
- 12163 1I **D-MelGAN: speech synthesis with specific voiceprint features** [12163-61]
- 12163 1J **Predicting urban PM2.5 concentration based on principal component analysis and BP neural network** [12163-123]

- 12163 1K **Regression model for apple yield prediction** [12163-84]
- 12163 1L **Numerical approximation method for multiscale model of map curve** [12163-44]
- 12163 1M **SIS infectious disease model with mean regression of mortality** [12163-47]
- 12163 1N **Prediction of Hepatitis C based on liver function test features** [12163-150]
- 12163 1O **COVID-19 fake news detection based on long short-term memory model** [12163-222]
- 12163 1P **Frequentist multi-armed bandits for complex reward models** [12163-48]
- 12163 1Q **Numerical methods and comparison for soliton solutions of the nonlinear Schrödinger equation** [12163-230]
- 12163 1R **Theory of decision tree models in classification problems** [12163-158]
- 12163 1S **Prediction model of consumer price preference based on machine learning** [12163-96]
- 12163 1T **Analysis and prediction of the Coronavirus epidemic in Tokyo, Japan** [12163-82]
- 12163 1U **Algorithm based on an improved profile-fitting tabu search for vaccine production scheduling** [12163-200]
- 12163 1V **Water level prediction based on improved WMCP-ARIMA model** [12163-38]
- 12163 1W **On the price dynamic of prediction market with behavioral traders** [12163-39]
- 12163 1X **Application of PCA and SPCA in classification** [12163-100]
- 12163 1Y **Optimization problem of C4 olefin production based on BP neural network prediction model** [12163-116]
- 12163 1Z **Geometric Brownian motion and its application in simulation of stock price** [12163-153]
- 12163 20 **Property about two-dimensional percolation model** [12163-137]
- 12163 21 **Fitting and prediction of China's output gap: an empirical study on ARMA model** [12163-54]
- 12163 22 **Analysis of vaccination on Markovian random walk model of epidemic proliferation** [12163-149]
- 12163 23 **Diffusion limited aggregation model** [12163-191]
- 12163 24 **Total retail sales forecasting method based on CEEMDAN, GPR combined model and CBR correction** [12163-40]

- 12163 25 **Predicting GRE score range using TOEFL score based on Bayes' theorem** [12163-232]
- 12163 26 **Analysis of factors affecting students' participation in sporting opportunities during school by building linear regression model** [12163-181]
- 12163 27 **The application of Markov random walk model on the epidemic spread of Covid-19 via SEIR and SEIRS model** [12163-184]
- 12163 28 **The optimization algorithm of power capacity increase in industrial park based on 0-1 integer linear programming** [12163-124]
- 12163 29 **Research and analysis of supplier selection and enterprise maximum production capacity based on simulated annealing and BP neural network model** [12163-133]
- 12163 2A **Comparison of models' performance for predicting depression under COVID-19** [12163-143]
- 12163 2B **Automated data-driven mining and learning of adoption prediction model in the United States** [12163-71]
- 12163 2C **Comparing existing tools in Python for modelling real-life optimisation problems with differential equations** [12163-95]
- 12163 2D **Model and forecast for China's GDP based on combined ARIMA and linear regression model** [12163-169]
- 12163 2E **Image analysis of energy structure and linear regression prediction on sustainable energy** [12163-73]
- Part Two**
- 12163 2F **Research on pollution discharge of papermaking enterprise based on game model** [12163-20]
- 12163 2G **Estimation and verification of landfill gas production by two typical prediction models in Gao Antun landfill** [12163-18]
- 12163 2H **Characteristics analysis of air pollution source emission in Qinhuangdao based on WRF/CALPUFF model** [12163-72]
- 12163 2I **Research on regional photovoltaic (PV) power output forecasting method based on weather pattern clustering** [12163-4]
- 12163 2J **Improvement of inverse distance weighted on regional gravity modelling based on least squares collocation** [12163-32]
- 12163 2K **Optimization model of total carbon emission control in the secondary industry of China** [12163-15]
- 12163 2L **Research on efficiency evaluation of China's coastal ports based on DEA-SBM model and GTFP index** [12163-21]

- 12163 2M **Market-oriented electricity price prediction method based on CNN-BiLSTM multi-feature fusion** [12163-29]
- 12163 2N **Prediction of future climate change in three provinces of Shaanxi, Gansu and Ningxia based on SSPs path** [12163-13]
- 12163 2O **Deep neural network approaches in hate speech detection** [12163-221]
- 12163 2P **ECC, RSA, and DSA analogies in applied mathematics** [12163-138]

COMPUTATIONAL MATHEMATICS AND MOBILE COMPUTING VISUALIZATION

- 12163 2Q **Higher-order of poles in dealing with complex plane analysis** [12163-175]
- 12163 2R **Randomness of the Gaussian variable and vectors** [12163-139]
- 12163 2S **Basic operations and properties of matrices** [12163-185]
- 12163 2T **Implementation of the forward Euler method in MATLAB** [12163-172]
- 12163 2U **Forward Euler method for ordinary differential equations** [12163-173]
- 12163 2V **A sampling method of dependent variable for least square regression** [12163-89]
- 12163 2W **Tietze-Urysohn theorem fails in constructive mathematics** [12163-210]
- 12163 2X **Response of hypersonic flow around a blunt wedge to the change of rough element position** [12163-43]
- 12163 2Y **Analysis on four paradoxes in terms of probability and mathematics** [12163-103]
- 12163 2Z **Distance between compact set and point in constructive metric space** [12163-224]
- 12163 30 **Research on fractal dimension and growth control of diffusion limited aggregation** [12163-213]
- 12163 31 **Applications of Minkowski's geometry of numbers** [12163-233]
- 12163 32 **Fundamental properties of complex numbers** [12163-201]
- 12163 33 **The method of residue and identities on harmonic numbers** [12163-106]
- 12163 34 **Simulation of geometric Brownian motion in stock price** [12163-160]
- 12163 35 **Finding patterns in the solutions to Pell's equation with $D < 5$** [12163-101]

- 12163 36 **Comparative study of mathematical optimization methods with computer simulation by Python** [12163-174]
- 12163 37 **Lasso and ridge regression methods and their application in GDP deflator estimation analysis** [12163-157]
- 12163 38 **Traveling wave solutions of a class of fifth order partial differential equations** [12163-41]
- 12163 39 **A multivariate spectral projection method for solving nonlinear monotone equations** [12163-42]
- 12163 3A **Evaluation of a complicated integral** [12163-186]
- 12163 3B **Study about three methods of solving linear equations** [12163-140]
- 12163 3C **Adaptive finite-time control of fractional-order-An System** [12163-112]
- 12163 3D **Dynamics of rational functions over different fields** [12163-229]
- 12163 3E **Analysis for the spread of COVID-19 in China based on the impulsive partial differential equation with diffusion** [12163-46]
- 12163 3F **Statistical derivation of linear regression** [12163-141]
- 12163 3G **Explore the relationship between fractal dimensions of diffusion-limited aggregations and probabilities of traps on sites** [12163-187]
- 12163 3H **Study on ground state solutions of fractional Laplace equations with logarithmic nonlinearity** [12163-81]
- 12163 3I **Complex numbers and applications in proving real identities** [12163-178]
- 12163 3J **Properties and visualizations of complex numbers and the complex plane** [12163-202]
- 12163 3K **Multiple solutions of variable exponential fractional Kirchhoff equation** [12163-79]
- 12163 3L **Geometric and topological structures of complex numbers** [12163-193]
- 12163 3M **Elliptic curve cryptography** [12163-235]
- 12163 3N **Arithmetic properties of the complex numbers** [12163-205]
- 12163 3O **Standardized formulation and proof of four-colour problem** [12163-90]
- 12163 3P **Coset decomposition of BCI-algebras** [12163-115]

- 12163 3Q **The inverse eigenvalue problem for a bordered anti-tridiagonal matrix** [12163-53]
- 12163 3R **Fundamental properties of complex integrals and series** [12163-208]
- 12163 3S **Application and simulation of differential equations in electricity** [12163-111]
- 12163 3T **Hyperbolic harmonic functions in complex $Cl_0(n+1)$** [12163-55]
- 12163 3U **A short proof on a complex inequality** [12163-192]
- 12163 3V **Equivalence between discrete Galerkin method and Runge-Kutta methods for initial value ordinary differential equations** [12163-194]
- 12163 3W **Various ways of Diophantine equation: Fermat's last theorem** [12163-76]
- 12163 3X **Multi-linear dimension of inscribed polygons** [12163-63]
- 12163 3Y **Research on polygonal numbers** [12163-92]
- 12163 3Z **Brownian motion and Box-Muller transformation** [12163-195]
- 12163 40 **Complex number and point-set topology** [12163-179]
- 12163 41 **Finding the Maxmin of constructive entries in arbitrary game theory matrices** [12163-239]
- 12163 42 **Constructive mathematics: left numbers and comparison** [12163-223]

BIG DATA ANALYSIS AND MACHINE DEEP LEARNING

- 12163 43 **Conversational machine reading comprehension based on cosine** [12163-57]
- 12163 44 **Research on optimization of asset-liability-management of bank based on interest rate risk control and growth** [12163-118]
- 12163 45 **Selection of important building materials suppliers based on technology for order preference by similarity to an ideal solution and grey comprehensive evaluation method** [12163-80]
- 12163 46 **Deep learning for hate speech detection** [12163-136]
- 12163 47 **COVID-19 diagnosis with convolution neural networks using CT images** [12163-219]
- 12163 48 **Application and progress of microfluidic systems based on microchannels** [12163-207]
- 12163 49 **Sensitivity of various factors of vaccination and quarantine for COVID-19** [12163-104]

- 12163 4A **Machine learning for solving high-dimensional partial differential equation** [12163-114]
- 12163 4B **Conformation simulation of polymer chain with SAW module** [12163-188]
- 12163 4C **Group structure of unity of roots** [12163-220]
- 12163 4D **Limiting process of symmetric simple random walk** [12163-145]
- 12163 4E **Research on investment strategies of stock market based on sentiment indicators and deep reinforcement learning** [12163-107]
- 12163 4F **Credit card fraud detection using supervised machine learning methods** [12163-204]
- 12163 4G **An investigation of Buffon's needle problem** [12163-74]
- 12163 4H **Optimizing VGG16 for lung cancer CT image recognition: evaluating the effectiveness of channel and spatial attention** [12163-156]
- 12163 4I **Neighbor sum distinguishable k-edge colorings of the join with two graphs** [12163-45]
- 12163 4J **Projective synchronization of different fractional order chaotic systems with non-identical orders and parameters identification** [12163-98]
- 12163 4K **Ant colony optimization and travelling salesman problem** [12163-151]
- 12163 4L **Inference for a constant-partially accelerated life tests with competing risks for failure from Burr distribution under progressively type-I interval censoring** [12163-52]
- 12163 4M **Efficiency analysis of provincial power grid enterprises in China: a nonparametric meta-frontier approach** [12163-70]
- 12163 4N **A regression analysis method based on big data research to calculate river loss** [12163-132]
- 12163 4O **Navigation safety evaluation of oilfield development platform based on subjective and objective combination weighting method** [12163-23]
- 12163 4P **Analysis on the joint risks of floods encountering tides in the reach of the Pearl River Basin based on the function statistics of the big data** [12163-126]
- 12163 4Q **Measurement of agricultural production efficiency from the perspective of ecological civilization and environmental protection** [12163-49]
- 12163 4R **Variations of surface ozone (O₃) pollution and its relationship with meteorological factors in Xinyang City during 2015-2019** [12163-14]
- 12163 4S **Deep learning techniques for stock market forecasting** [12163-152]

- 12163 4T **Linear regression in machine learning** [12163-161]
- 12163 4U **Xi'an network attention measurement in the post-epidemic era** [12163-35]
- 12163 4V **Temporal and spatial changes of vegetation coverage in the five northwestern provinces in the past 20 years based on MODIS_NDVI** [12163-11]
- 12163 4W **Study and improvement of front row female occupant injuries in full width frontal test** [12163-27]
- 12163 4X **Simulation study on R134a casing evaporator** [12163-7]
- 12163 4Y **Impingement characteristics of super cold droplets on hydrophobic surfaces with different microstructures** [12163-134]
- 12163 4Z **Dynamic response characteristics of hybrid fiber metal laminates under inclined impact** [12163-102]