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A review on multi objective optimization problems and advancement on its solutions

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Abstract

A plenty of literatures are available for finding solution of optimization problem of single objective. Very few literatures are available for finding solution of optimization problem with multi objective optimization. Many researchers analysing multi objective problems by treating as single objective, keeping rest of variables as constant. With the tremendous rise of innovations in evolutionary computation, that has added feathers to Multi Objective Optimization techniques.

Keywords: Multi Objective Optimization Problems (MOOP); Pareto solution

1. Introduction

Real world problems involving several conflicting objectives must be simultaneously optimized in order to get satisfactory result. To optimize conflicting objectives in MOOPs as Many works have been satisfactorily done in the literature for single objective problems using evolutionary computation but A few works are done for multi objective problems using evolutionary computation. To identify pareto solution which will be good approximation to fit for MOOPs

To determine the accurate solution of our multi objective problems involving much more complexity. To determine best result from the pareto optimal space comparing other developed methods. To optimize many objectives simultaneously emphasizing objective of importance

Seth et al. [1] examined numerical solution of unsteady MHD natural convection flow of a viscous, incompressible, electrically conducting and heat absorbing fluid past an impulsively moving vertical plate with ramped temperature embedded in a porous medium in the presence of thermal diffusion is carried out. They conclude that magnetic field and heat absorption tend to retard fluid velocity whereas thermal buoyancy force and thermal diffusion have reverse effect on it and thermal diffusion tends to enhance fluid temperature whereas heat absorption has a reverse effect on it. Mahato et al. [2] have considered MHD flow and heat transfer of nanofluid over a stretchable surface with melting, where chemical reaction effects discussed. Such nanofluid flows find applications in heat transfer processes, pharmaceutical processes, domestic refrigerators, heat exchanger, engine cooling, vehicle thermal management etc. Heat radiating, electrically conducting, incompressible, steady flow of a viscous and chemically reacting nano-fluid past a stretching sheet, with melting, in the presence of an applied transverse magnetic field, examined by Mahato et al. [3].Seth et al. [4] have discussed the effects of hall current and rotation on steady MHD Couette flow of Class-II of a viscous, incompressible and electrically conducting fluid in the presence of a uniform transverse magnetic field. Here also derived some expressions for shear stress at the lower and upper plates due to primary and secondary flows and mass flow rates in the primary and secondary flow directions. Seth et al. [5] have investigated the unsteady hydromagnetic Couette flow of a viscous, incompressible and electrically conducting fluid between two infinitely long

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parallel porous plates, taking hall current into account, in the presence of a transverse magnetic field. Seth at al. They have concluded that the Hall current tends to retard fluid flow in the primary flow direction throughout the channel and fluid flow in the secondary flow direction in the upper half of the channel. Magnetic field tends to accelerate fluid flow in both the primary and secondary flow directions. Similarly Das et al.[6], Ray et.al[7], Kanungo et.al[8] and Mishra et.al [9,10] have studied the effects of different flow parameter on flow and heat transfer process of fluid flow.In their study they have kept all other parameter fixed except varying single parameter. So though those are multi objective problems but are treated as single objective to analyze the solutions.

Mohapatra et.al.[11] have studied the Equalization of communication channels problem using Genetic Algorithms (GA) that is more advantageous as compared to Radial Basis Function Neural Network (RBFNN). Siddique et al. [12] have used integration of kernel principal component analysis, support vector machine with teaching learning based optimization algorithm for forecasting model of stock market. Samantara [13] has developed a model for construction of functions, out of the given dynamic data by using neural network method. He has updated the parameters whenever there is change in data set. Samantara et.al.[14,15] have analyzed stock market forecasting problems using machine learning techniques. Nanda et.al [16-23] have analyzed the multi optimization problems using different machine learning algorithm like Classification rule mining algorithm, Ant colony Optimization

Pattanaik et.al[24,28] have analyzed the classification problem for Breast cancer detection considering multiple criterias. Siddique et.al [25,26,29]have analyzed stock market index using machine learnig algorithms. Mishra et.al [27,32,33,37-39] have studied auto desk modeling for satellite cities, Labour issues and urban flooding using evolutional computations. Mohapatra et.al [30] have done intensive study in automated invasive cervical cancer disease detection using deep learning techniques. Behera et.al[31] have analyzed vertical multistoried structures over incompetent soils taking in account of multiple factors. Jagadeesan et.al [34] have worked on Smart Medicine Assistive System for Patients using machine learning techniques.Ansaret.al. [35] have worked for detecting radiation-induced tissue inflammation in patients with Lung Cancer using machine learning techniques. Mohapatra [36] have analyzed Optimized Structural Performance of Paver Blocks. Dash [40]have studied on Congestion and Performance Evaluation of Roundabouts in a city. Ojha[41]have worked on bauxite waste as cement substitute after normalization considering multiple criteria .

2. Conclusion

In this paper the different types of optimization problems have been studied starting from single optimization to multi optimization problems. It is very much difficulty to handle multi optimization problems precisely. Using of machine learning methods can give accurate results some extent.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Seth GS, Sarkar S and Mahato GK. Numerical solution of unsteady hydromagnetic natural convection flow of heat absorbing fluid past an impulsively moving vertical plate with ramped temperature. International Journal of Applied Mathematical Research. 2013; 2 (2): 317-324. DOI: https://doi.org/10.14419/ijamr.v2i2.939

[2] Mahato GK, Mahatha BK, Nandkeolyar R and Patra B. The effects of chemical reaction on magnetohydrodynamic flow and heat transfer of a nanofluid past a stretchable surface with melting. AIP Conference Proceedings. 2020; 2253(1), 020011-1–020011-13. DOI: https://doi.org/10.1063/5.0019205 , ISBN: 978-0-7354-2012-0

[3] Mahato GK, Mahatha BK and Samal S. Melting Heat Transfer on Magneto- hydrodynamic (MHD) Flow of a Heat Radiating and Chemically Reacting Nano-Fluid past a Stretchable Surface. JP Journal of Heat and Mass Transfer. 2019; 17 (2): 379-398. DOI: http://dx.doi.org/10.17654/HM017020379

[4] Seth GS, Mahato GK and Singh JK. Effects of Hall current and rotation on MHD Couette flow of class-II. Journal of International Academy of Physical Sciences. 2011; 15 (5) Special Issue-1: 213-230.

[5] Seth GS, Singh JK and Mahato GK. Unsteady hydromagnetic Couette flow within a porous channel with Hall effects. International Journal of Engineering. Science and Technology. 2011; 3 (6): 172-183. DOI: 10.4314/ijest.v3i6.14

[6] Das Tusharkanta, Samantara Tumbanath, Sahoo Sukanta Kumar, Radiation Effects on the Unsteady MHD Free Convection Flow Past in an Infinite Vertical Plate with Heat Source, International Journal of Mathematical and Computational Sciences,World Academy of Science,Engineering and Technology Vol-14, Issue-6, pp-61-66

[7] Ray Satyajit, Samantara Tumbanath, Siddique M. ,Study of effects of radiation on heat transfer of two phase boundary layer flow over a stretching sheet, International Journal on Emerging Technologies, Vol-10,Issue-2b,pp-203-207

[8] Kanungo Subhrajit, Samantara Tumbanath , Flow And Heat Transfer of Unsteady Two-Phase Boundary Layer Flow Past an Inclined Permeable Stretching Sheet with Electrification of Particles, CFD Letters,2023,Vol-15,Issue-5,pp-134-144, https://doi.org/10.37934/cfdl.15.5.134144

[9] Mishra Jayaprakash, Samantara Tumbanath , Effect of Radiation and Non-Uniform Heat Source/Sink on Flow over a Linear Stretching Sheet with Fluid Particle Suspension, CFD Letters,2023,Vol-15,Issue-6,pp-42-53 , https://doi.org/10.37934/cfdl.15.6.4253

[10] Mishra Jayaprakash, Samantara Tumbanath and Tripathy Pradeep Kumar, Effects of Electrification and Transverse Force on Dusty Flow over a Linear Stretching Sheet, CFD Letters,2024,,Vol-16,Issue-2 pp-151-161, https://doi.org/10.37934/cfdl.16.2.151161

[11] Mohapatra. P., Samantara, T., Panigrahi, S.P., Nayak, S.K., Equalization of communication channels using GA-trained RBF networks, Progress in Advanced Computing and Intelligent Engineering: Proceedings of ICACIE 2016, 2017,Volume564 , PP_ 491-499, DOI: https://doi.org/10.1007/978-981-10-6875-1_48

[12] Siddique Mohammed, Samantara Tumbanath and Mishra Siba Prasad. A hybrid prediction model of kernel principal component analysis, support vector regression and teaching learning based optimization techniques, Current Journal of Applied Science and Technology,Vol:40, Issue:20,pp -17-25

[13] Samantara Tumbanath, Application of Neural Networks in Model Updation Using Frequency Response and Radial Basis Function Network ,Machine Learning and Information Processing, Advances in Intelligent Systems and Computing,2020,1101, Springer Nature Singapore Pte Ltd., pp-439 https://doi.org/10.1007/978-981-15-1884-3_40

[14] Samantara Tumbanath, Patel Binita, Sidique Mohammod, Impact of stock index parameters on prediction of stock index of HDFC bank using deep learning neural network model, Shodh Sanchar Bulletin,2020, Vol-10,issue 40 pp- 59-66

[15] Samantara Tumbanath , Naik Snigdhamayee , Sidique Mohammod,Impact of different parameters on forecasting stock price of TaTa steel using machine learning techniques, Shodh Sarita, Vol-7 Issue-28 , pp- 59-65

[16] Nanda, B.K. and Dehuri, S. N. (2020) Ant Miner –A Hybrid Michigan Style Classification rule mining algorithm. IJAEC, vol.-11, issue No.-2 pp-47-64, ISSN:1942-3594,e-ISSN-1942-3608,

[17] Nanda, B.K.and Dehuri, S. N. (2020) Ant Miner –A Hybrid Pittsburgh Style Classification rule mining algorithm. IJAIML, vol-10, issue No.-1 pp-45-59, ISSN:2642-1577,e-ISSN- 2642-1585.

[18] Nanda, B.K. and Dehuri, S. N. (2020) Ant colony Optimization for Intractable Problems, A steps by Step Approach. Test Engineering,&Manegment, vol-82, issue No.- January-Februry-2020, pp-5970-5975, ISSN:0193-4120.

[19] Nanda, B.K. and Dehuri, S. N.(2019) Ant Colony Based K Mediod for Data Clustering. IUP Journal of IT, vol-15, issue No.-4, pp-25-42, ISSN:0973-2896.

[20] Nanda,B.K.and Das, G. (2017). Ant Based Clustering: A Comparative Study ,IJICAS, vol-5issue No.-1 pp. 14-22. ISSN: 2322-0031.

[21] Nanda,B.K., and Das,G. (2013). Ant Colony Optimization. A Computational Intelligent Technique. (IJCCT), vol-4, issue No.-1, pp. 92-97. ISSN:0975-7449

[22] Nanda,B.K. and Das, G. (2013). Class Based Rule Mining Using Ant Colony Optimization. (IJACTE), vol-2, issue No.-1, pp. 25-30. ISSN: 2319-2526.

[23] Nanda, B. K., Dehuri, S. N. and Cho, S. B. (2009). A Hybrid APSO - aided Learnable Bayesian Classifier. In proceedings of Indian International Conference on Artificial Intelligence (IICAI-09), pp. 695-706.

[24] Pattanaik R.K., Mishra S., Siddique M., Gopikrishna T., Satapathy S. Breast Cancer Classification from Mammogram Images Using Extreme Learning Machine-Based DenseNet121 Model, Journal of Sensors, Hindawi Publication, ISSN No: 1687-725X, Volume 2022, Article ID 2731364, page:1-12, 2022

[25] Siddique, M., Panda, D., A hybrid forecasting model for prediction of stock index of tata motors using principal component analysis, support vector regression and particle swarm optimization International Journal of Engineering and Advanced Technology, 2019, 9(1), pp. 3032–3037

[26] Siddique, M; Panda, D., Das, S., Mohapatra, S: Hybrid forecasting model for stock value prediction using soft computing technique, International Journal of Pure and Applied Mathematics, 2019, Vol. 117 (19); 357-363. ISSN:1311-8080

[27] Mishra, S.P., Nayak, S.P., Mishra, S., Siddique, M., Sethi, K.C.: GIS and auto desk modeling for satellite cities around Bhubaneswar, International Journal of Innovative Technology and Exploring Engineering, 2019, 8(11), pp. 297–306.

[28] Pattnaik,R.K, Siddique, M, Mishra, S, Gelmecha, D.J, Singh, R.S, Satapathy,S.,Breast cancer detection and classification using metaheuristic optimized ensemble extreme learning machine, International Journal of Information Technology, Sringer Nature Singapore, 2023 15 (8), 4551-4563

[29] Siddique, M., Panda, D., Prediction of stock index of tata steel using hybrid machine learning based optimization techniques, International Journal of Recent Technology and Engineering, 2019, 8(2), pp. 3186–3193.

[30] Mohapatra,S., Siddique,M., Paikaray, B.K, Riyazbanu, S., Automated Invasive Cervical Cancer Disease Detection at Early Stage Through Deep Learning, International Journal of Bioinformatics Research and Applications, 2023, 19(4), 306-326.

[31] Behera,S.K, Mishra,S.P, Panda,S, Siddique, M, An Autodesk Modeling of Urbanization by Vertical Multistoried Structures over Incompetent Soils, International Journal of Engineering and Advanced Technology, 2019, 9(1): 3332-3342

[32] Mishra, S.P., Mishra, S., Siddique, M., Lean Labour in AEC Industry: From Theory to Implementation, International Journal of Recent Technology and Engineering, 2020, 8(6), 1159-1169

[33] Mishra, S.P, Sethi, K.C., Siddique, M., Emerging Threats during Anthropocene as Urban Flooding of Bhubaneswar City, India, Water and Energy International, 2020, 63(1)-46-58.

[34] Jagadeesan, S., Danga, S.K., Uma, V., Siddique, M., Venu, N, Implementation of an Internet of Things and Machine learning Based Smart Medicine Assistive System for Patients with Memory Impairment, International Journal of Food and Nutritional Sciences, 2022, 11(8), 1191-1202 ISSN:2320-7876.

[35] Ansari, A.L, Sundararajan, J., Siddique, M, Machine Learning Methods for Detecting Radiation-Induced Tissue Inflammation in Patients with Lung Cancer, International Journal of Food and Nutritional Sciences, 2022, 11(1), 2315-2322, ISSN: 2320-7876.

[36] Mohapatra P.D., Mishra S.P., Nayak, S., Siddique, M., Optimized Structural Performance of Paver Blocks of Bajri Concrete: NRM Partly Substituting Cement, International Journal of Innovative Technology and Exploring Engineering, 2019, 9(1),1938-1949, ISSN: 2278-3075

[37] Mishra, S.P., Sethi, K.C., Mishra, D.P., Siddique, M., Pre-Monsoon Cyclogenesis over Bay of Bengal, International Journal of Recent Technology and Engineering, 2019, 8 (2), 4895-4908; ISSN: 2277-3878

[38] Mishra, S.P., Mishra, S., Siddique, M., The Anthropocene Dialogues on Climate Change to Human Health of Homosapiens in India, Current Journal of Applied Science and Technology, 2020. 39(24), 13-30, ISSN No: 2457-1024

[39] Mishra,S.P., Mishra, S., Siddique,M., Lean Labour in AEC Industry: From Theory to Implementation, International Journal of Recent Technology and Engineering, 2020, 8(6), 1159-1169, ISSN: 2277-3878

[40] Dash, D.K., Mishra, S.P., Siddique, M., Panda,S., Congestion and Performance Evaluation of Roundabouts; Case Study at Bhubaneswar City; India, Design Engineering (Toronto); 2021, Issue-4, Page-181-195, ISSN No: 0011-9342,

[41] Ojha,B., Mishra, S.P., Nayak,S., Panda,S., Siddique,M., Bauxite Waste as cement Substitute after Normalisation: Sustaining environment, Journal of Xidian University,2020, 14(4), 1449-1463, ISSN: 1001-2400