MAIN RESULTS AND SCIENTIFIC CONTRIBUTIONS
of Assist. Prof. eng. Dimitar Borisov Borisov, PhD,
Department: "Environmental Engineering", submitted for participation in a competition for position: "associate professor" in scientific field 5. Technical sciences, professional field 5.13 General Engineering (Technologies and Systems for Environmental Protection), announced by the University of Chemical Technology and Metallurgy – Sofia in the State Gazette, issue 104/ 05.12.2025

I. MAIN THEMATIC DIRECTIONS

I.1 Optimization of technological objects and systems;
I.2 Multicriteria optimization and optimal decision-making in environmental protection;
I.3 Application of neural networks and deep learning in environmental protection;
I.4 Energy efficiency and sustainable development.

II. SUMMARY OF SCIENTIFIC PUBLICATIONS

Group of indicators "3 and 4", Indicator 3: Habilitation work - a monograph based on no less than 5 publications in refereed journals, with which the candidate has not participated in previous procedures.

Monograph: Dimitar Borisov, "Effective methods for optimization and rational optimal decision-making, Academic Publishing House of IIIT - Plovdiv, 2025, p. 225. ISBN: 978-619-91382-8-1. Summary of the main conclusions of the monograph:

(1)

A new heuristic optimization algorithm with accelerated convergence for searching the maximum of one-dimensional unimodal objective functions is proposed. The algorithm is a combination of the dichotomy method, the Kiefer–Johnson method, and a fourth-order (grade) functional series. The newly proposed combined series provides a much faster reduction of the interval of uncertainty compared to the best combined scheme known in the literature to date. The newly proposed combined schemes 4-2-F, 4-F, as well as the pure power series of double dichotomy, change the trend of variation in the number of objective function evaluations toward a decrease in the average number of evaluations as the interval of uncertainty increases when searching for the extremum of unimodal objective functions. The new methods implementing the proposed algorithm are significantly more efficient than the classical methods with respect to the criterion of the number of objective function evaluations required to find the optimal solution. From the study and the results obtained, it is clear that the proposed new combined order achieves a much faster reduction of the interval of uncertainty compared to the best combined scheme known so far in the literature, namely 2–F. This effect is most pronounced for large intervals of uncertainty and demonstrates much higher efficiency compared to traditional one-dimensional extremum search strategies such as dichotomy, golden section, and the Kiefer–Johnson method using only the Fibonacci numbers sequence.

(2)

A fast-converging combined algorithm is proposed, which integrates the positive features of the random directions method and the random search method with the penalty of chance. The strategy of the proposed variants of the new method is: starting from an initial point, to generate a "set" of consecutively successful random directions with equal random vector length, after which the direction yielding the best function value is selected as the base direction. From this base direction, the

extremum is localized using the idea of the random search method with a penalty for randomness until an unsuccessful result is obtained, but with an increasing step size. The last best result is then taken as a new initial point. The method is universal and can be modified and applied both for optimization of ridge type functions and for global extremum search, using multiple random starting points.

(3)

A new accelerated algorithm for multidimensional optimization of complex ridge type objective functions is proposed. The main goal is to combine the advantages of the random search method using multiple random directions with a constant step size for extremum search of unimodal functions, and the advantages of the Gelfand–Tsetlin method. From the conducted study on a strongly ravine-type objective function and the obtained results, it is evident that the proposed new algorithm achieves from 2 to 4 times faster convergence in locating the extremum compared to the classical Gelfand–Tsetlin method under identical initial conditions for given starting points, desired accuracy, step parameters, and size of the admissible search space.

(4)

A new global optimization algorithm is proposed, which borrows only the idea introduced by Price for grouping and analyzing sets of points. Price proposed an algorithm in which, from M uniformly distributed random points, groups of points are randomly selected, analyzed, and used to compute new points that replace those with the worst objective function values. A disadvantage of Price's algorithm is the insufficiently justified choice of the number of points in the cluster groups that continue the search after discarding the points with the worst objective function values.

In the newly proposed method, groups of point pairs are formed, based on which new points are computed to replace the worst ones. In the presented new method, as well as in Price's method, the worst result values are continuously improved, causing the points to gradually concentrate around the global maximum. From the conducted studies of the proposed new methods for global extremum search, tested with representative complex multimodal test functions, and from the obtained results, faster convergence of the four proposed variants of the new method is confirmed. With higher priority, algorithms MGO_3 and MGO_4 can be highlighted, as they are more efficient than MGO_1 and MGO_2 across all tested multimodal functions. The convergence speed of the proposed methods significantly exceeds that of Price's method. The results show that the manner in which point pairs are formed affects the convergence speed. When pairs are formed in a linear direction (variants MGO_3 and MGO_4), better convergence is observed compared to variants MGO_1 and MGO_2. The initial formation of $Group_1$ and $Group_2$ also has an impact on convergence.

(5)

The sensitivity of three basic graphical transformations into dimensionless coefficients varying in the interval $[0 \div 1]$ is studied. Based on real technological examples, it is demonstrated that the best and most sensitive solution is obtained when using Harrington's double exponential transformation, followed by the exponential transformation. The roughest solution is obtained with the linear transformation. A new linear transformation in the interval $[0 \div 2]$ is proposed, and its sensitivity is studied. As a result of this study, it is proven that doubling the interval does not affect the stability and sensitivity of the solution.

(6)

Eight fractional-rational generalized strategies for finding an optimal solution, with and without the use of weighting coefficients, are proposed. The proposed strategies are studied using real technological examples. Results are presented, and leading (optimal) solutions are recommended. The

widest range of variation, and correspondingly the highest sensitivity, is observed in the fractional-rational generalized harmonic-mean strategy for rational decision making. In multicriteria optimization, the selection of a compromise solution is most strongly influenced by the type of generalized strategy, the type of compromise solution acceptable to experts, and the determination of the most desirable (recommended) value.

The conclusions are in the scientific thematic field: I.1 and I.2.

Group of Indicators "7 and 8":

Indicator 7:
Scientific publication (article or paper) published in journals or proceedings that are peer-reviewed and indexed in internationally recognized scientific databases.

7.1. D. Borisov, Slag quantity minimization in the pyrometallurgical production of anode copper, Journal of Chemical Technology and Metallurgy, ISSN 1314-7471 (print), ISSN 1314-7978 (on line), 54, 5, 2019, 1047 – 1060.

Abstract:
The paper is in the scientific thematic field I.2. This paper presents approximate mathematical models, numerical data and graphical results obtained from virtual planned experiments on a verified analytical mathematical model. Two adequate approximating polynomial mathematical models have been developed, which can be used to optimize the amount of produced metal and to minimize the quantities of industrial waste (slag) in pyrometallurgical processes of flash smelting of sulfide copper raw materials. The proposed mathematical models allow the determination of a number of Pareto-optimal solutions. The approximation models can be used for operational planning, product optimization, process control, and minimization of waste material flows.

7.2. D. Borisov, Mathematical modeling and multicriteria optimization of the ceramic indicators of the refractory linings of steel foundry ladles, Journal of Chemical Technology and Metallurgy, ISSN 1314-7471 (print), ISSN 1314-7978 (on line), 58, 1, 2022, 208-216.

Abstract:
The paper is in the scientific thematic field I.2. The subject of the present study is to determine the influence of two independent variables on the quality indicators of driving masses used in the refractory lining of steel ladles in metallurgy. A statistical evaluation of the properties of driving mixes with three different Al_2O_3 contents has been performed. The linear correlation between the quality indicators of the driving mixes has been studied for different combinations of two main independent variables. A multicriteria optimization of the generalized functions has been carried out for three different quality indicators in order to determine the optimal amount of clay component (Al_2O_3) and the temperature of thermal treatment of the inner lining of steel ladles.

7.3. D. Borisov, Multi-criteria study of the quality indicators of quartz driving masses by fractional-rational generalized functions, Journal of Chemical Technology and Metallurgy, ISSN 1314-7471 (print), ISSN 1314-7978 (on line), Vol. 58, Issue 5, 2023, pp 945-954.

Abstract:
The paper is in the scientific thematic field.2. As a result of this scientific and applied study, second-order full regression mathematical models were obtained for six quality indicators (target parameters) of "Fosuk" type driving mixes. The adequacy of the obtained regression equations for the quality indicators has been confirmed. The optimal values of the clay substance $Al_2 O_3$ content (%) and the thermal treatment temperature (°C) have been determined. Contour lines of constant values for each quality indicator are presented within the range of variation of the $Al_2 O_3$ content and the thermal treatment temperature. A multicriteria optimization based on arithmetic mean, geometric mean, and harmonic mean functions of utility has been performed. An analysis of multicriteria decision-making strategies has been done using a fractional-rational generalized functions of utility.

Indicator 8:
Scientific publication (article or paper) published in non-refereed journals with scientific reviewing or in edited collective volumes.

8.1. V. Stefanova, M. Georgiev, D. Borisov, R. Miletiev, "Effect of the temperature on the direct conversion of the chemical energy of H_2O_2 to electric", Journal of University of Chemical Technology and Metallurgy, volume 44, issue 4, 2009, 289-394.

Abstract:
The paper is in the scientific thematic field I.4. This scientific paper presents an analytical study of the influence of temperature in the range 298K – 333K on the electrochemical potentials of possible half-reactions between the products of oxygen reduction during the direct conversion of the chemical energy of hydrogen peroxide into electrical energy. It has been established that in an acidic medium the generated electrical voltage does not depend on the pH of the solution and is 14% higher than that in an alkaline medium. With increasing temperature, this difference decreases to 10%.

8.2. D. Borisov, Investigation of Heuristic Algorithms for One Dimensional Optimization with Accelerated Convergence, Information technologies and control, 1, 2018, 2-7, Print ISSN: 1312-2622; Online ISSN: 2367-5357, DOI: 10.1515/itc-2018-0001.

Abstract:
The paper is in the scientific thematic field I.1. This paper proposes a new heuristic optimization algorithm with accelerated convergence for searching the maximum of one-dimensional unimodal objective functions. The algorithm is a combination of the dichotomy method, the Kiefer–Johnson method, and fourth-order functional series. From the conducted study and the obtained results, it is evident that the proposed new combined scheme provides a much faster reduction of the interval of uncertainty compared to the best combined scheme known in the literature to date, namely 2–F and much faster than classical methods as dichotomy, golden section, and the Kiefer–Johnson method.

8.3. D. Borisov, Priority Estimation of Quality Indicators in Hazardous Wastes Management, Journal of Science, Engineering & Education, 4, (1), 2019, 9-18.

Abstract:
The paper is in the scientific thematic field I.2. In the present paper, an assessment is done and priorities are determined for 20 key indicators related to hazardous waste management, distributed into two groups. The optimal decisions in multicriteria optimization problems in quality control largely depend on the priorities and weighting coefficients (W_j) assigned to the different quality

characteristics. There are no strictly formalized methods for evaluating importance, priority, and weighting coefficients. Two questionnaires with 10 indicators each have been developed. Priorities and weighting coefficients are determined through ranking of the quality indicators. Consistency ratios have been calculated and their significance has been evaluated.

8.4. D. Borisov, Investigation of heuristic algorithms for multydimensional optimization with accelerated convergence, Journal Of Informatics And Innovative Technologies (JIIT), ISSN 2682 – 9517 № 1 (1), 2019, 42-47.

Abstract:

The paper is in the scientific thematic field I.1. This paper proposes a new heuristic optimization algorithm with accelerated convergence for searching the optimum of unconstrained multidimensional unimodal objective functions. The algorithm is a combination of the random directions method and the random search method with the penalty of chance. A comparative analysis with other well-known methods has been carried out, and its efficiency and accelerated convergence have been demonstrated. The method and the proposed algorithm are suitable for parameter estimation in mathematical models.

8.5. D. Borisov, An accelerated algorithm for finding the optimum of complex ridge type objective functions, Journal Of Informatics And Innovative Technologies (JIIT), ISSN 2682 – 9517 № 2-3 (1), 2019, 91 – 96.

Abstract:

The paper is in the scientific thematic field I.1. This scientific paper proposes a new heuristic optimization algorithm with accelerated convergence for complex multidimensional ridge type objective functions. The main goal is to combine the advantages of the random search method from multiple random directions with a constant step for searching for the extremum of unimodal functions and the advantages of the Gelfand and Tsetlin. A comparative analysis with classical methods for extremum search of ridge type objective functions has been performed, and the effectiveness of the proposed method has been demonstrated.

8.6. D. Borisov, A new heuristic one dimensional optimization algorithm with accelerated convergence in boundless space, Journal Of Informatics And Innovative Technologies (JIIT), ISSN: 2683-0930, № 1 (2), 2020, 11 – 18.

Abstract:

The paper is in the scientific thematic field I.1. A new heuristic algorithm with accelerated convergence for one-dimensional optimization in an unbounded space is proposed and investigated in this paper. The algorithm uses the first four Fibonacci numbers and a third-order numerical series. A comparative study is presented with three other efficient algorithms: golden-section search, the Kiefer–Johnson method using Fibonacci numbers, and a combined method incorporating the dichotomy and Kiefer–Johnson–Fibonacci methods. The results show that the newly proposed method exhibits a superior convergence rate.

8.7. S. Stoyanov, D. Borisov, Strategy for optimal decision making by generalized fractional rational function, Journal Of Informatics And Innovative Technologies (JIIT), ISSN: 2682 – 9517 (print) ISSN: 2683 – 0930 (online), № 2-3 (2), 2020, 1 – 6.

Abstract:
The paper is in the scientific thematic field I.2. This paper proposes three new strategies for optimal decision-making. The strategies are based on newly developed generalized fractional-rational functions of utility. The first strategy is designed as a fractional-rational additive type, the second as a fractional-rational multiplicative type, and the third as a geometric-mean type. The new strategies are tested wih a practical problem. The results show that the multiplicative-type strategy exhibits the best practical performance. The proposed new strategies are more sensitive to changes in the controlling parameters.

8.8. D. Borisov, S. Stoyanov, Optimal Decision Making By Different Generalized Desirability Functions, Journal of informatics and innovative technologies (JIIT), ISSN: 2682 – 9517 (print) ISSN: 2683 – 0930 (online), № 4 (2), 2020, 11 – 17.

Abstract:
The paper is in the scientific thematic field I.2. New type of strategies for optimal decision making are proposed and investigated in this paper. The strategies are based on the generalized functions of desirability. The variety of creating the generalized function of desirability includes various transformations of the several objective parameters in linear, exponential and multi-exponential type. The sensitivity of the new generalized functions of usefulness is tested by a practical problem to choose an optimal offer of a trade product. The results are showing: The arithmetical mean exponential transformation is giving higher values comparing with linear transformation and transformation of Harrington. The Harrington transformation differs strongly the offers classified on lowest ranks.

8.9. D. Borisov, Comparative analysis of generalized objective functions used in multicriteria optimization, Journal Of Informatics And Innovative Technologies (JIIT), ISSN 2682 – 9517 № 2 (3), 2021, 35-42.

Abstract:
The paper is in the scientific thematic field I.2. Some known and new proposed kind of strategies for multicriteria optimization are investigated and compared in the present paper. All strategies are based on the generalized functions of usefulness. The investigation of the new generalized functions is tested by a practical problem to choose a Pareto-optimal variant of production of a trade product. The comparison shows that the best practical property has the additive type of generalized objective function and some of the new strategies are more sensitive to the control variables changes. In the multiplicative form for creation of a generalized objective function, the highest values of the generalized utility function strongly dominate. Additive and harmonic forms give a wider range of options in the ranking of the best solutions.

8.10. D. Borisov, Multicriteria decision making through fractional rational generalized functions, Journal Of Informatics And Innovative Technologies (JIIT), ISSN 2682 – 9517 № 3 (3), 2021, 37 – 46.

Abstract:
The paper is in the scientific thematic field I.2. When solving multicriteria optimization problems, the choice of a compromise solution strongly depends on the way of creation of the generalized objective function, which unites the set of objective parameters. In the present paper, a comparative analysis of three types of transformations (linear, exponential and double exponential) is made. The properties,

the efficiency of the methods and their sensitivity of the decisions made depending on the control parameters are studied by using six types of generalized fractional rational functions of utility.

8.11. D. Borisov, An heuristic algorithm for searching a global optimum, based on group analysis, Journal Of Informatics And Innovative Technologies (JIIT), ISSN 2682 – 9517 № 2 (4), 2022, 11 – 20.

Abstract:

The paper is in the scientific thematic field I.1. In this paper, a new heuristic optimization algorithm with accelerated convergence is proposed for searching for a global optimum of multidimensional, multimodal objective functions. The new optimization algorithm is based on the idea proposed by Price for grouping and cluster analysis. In the new method, as in the Price method, the values of the worst result are constantly improved and thus the points begin to condense around the global maximum. A comparative analysis with the classical Price method is made and its efficiency and accelerated convergence are demonstrated. The method and the proposed algorithm are suitable and efficient for complex multimodal objective functions and for estimating parameters in mathematical models. The results show that the way of forming the pairs of points has an impact on the speed of convergence. When forming the pairs in the straight direction (variants MGO_3 and MGO_4), better convergence is observed compared to varieties MGO_1 and MGO_2. The manner in which Group 1 and Group 2 were initially formed also has an impact on convergence.

8.12. D. Borisov, Priorities and weight coefficients determining for the quality indicators of quartz ramming masses, Journal Of Informatics And Innovative Technologies (JIIT), ISSN 2682 – 9517 № 3 (4), 2022, 13 – 16.

Abstract:

The paper is in the scientific thematic field I.2. In the present study, an algorithm for determining the weight coefficients of the objective indicators based on the opinions of experts and the possibility to reduce the number of indicators by eliminating those with the lowest priority is proposed. It is proposed to do this in combination with the study of the correlation between the objective parameters. The present study on a real technological problem proposes using of subjective opinions and the objective assessment of their concordance to rank the priorities of the objective indicators when making compromise decisions.

8.13. D. Borisov, S. Stoyanov, Multi-criteria optimal rational decision-making taking into account the priorities of objective indicators, Journal of informatics and innovative technologies (JIIT), ISSN: 2682 – 9517 (print) ISSN: 2683 – 0930 (online), № 4 (4), 2022, 7 – 19.

Abstract:

The paper is in the scientific thematic field I.2. In this paper three new innovative strategies using generalized functions of usefulness of additive, multiplicative and harmonic type and three strategies of fractional-rational type have been proposed and studied with a practical example, and their effectiveness has been analyzed without and with consideration of their priorities. From the comparative analysis of the proposed strategies, the following conclusions can be summarized: Among the investigated strategies the most competitive are the strategies in which the generalized objective function of additive and multiplicative type is created, without and with the introduction of priorities of the variants for which the generalized function is created. When the fractional-rational generalized objective function creation strategies of the kind F-4, F-5 and F-6 are used, the number

of competing decision options is significantly greater than when strategies F-1, F-2, and F-3 are used. The generalized objective functions of arithmetic mean and geometric mean kind most realistically describe the usefulness of the variants with and without taking into account the priorities.

8.14. Dinh Cong Tung, Do Thi Huyen, D. Borisov, Research and building a fire-detecting model based on data preprocessing and convolutional neural network, Journal of informatics and innovative technologies (JIIT), ISSN: 2682 – 9517 (print) ISSN: 2683 – 0930 (online), № 2-3 (5), 2023, 3 – 8.

Abstract:
The paper is in the scientific thematic field I.3. This paper proposes a method to improve the accuracy of fire detecting deep learning model through data preprocessing. The preprocessing methods utilized the HSV color space to highlight fire related features, and the FAST corner detector was used to scan and extract Regions of Interest. After that, a deep Convolutional Neural Networks model was trained to detect the presence of fire within these Regions of Interest. Through the proposed method, the accuracy of fire detection improved by approximately 5% compared to a model without preprocessing, and it is outperformed to other deep learning models.

8.15. Ngoc Dung Bui, Quang Tuyen Vu, Long Ngo, Thanh Binh Ngo, D. Borisov, Objects detection in autonomous vehicles using YOLOV5, , Journal of informatics and innovative technologies (JIIT), ISSN: 2682 – 9517 (print) ISSN: 2683 – 0930 (online), № 2-3 (5), 2023, 29 – 34.

Abstract:
The paper is in the scientific thematic field I.3. This paper presents a study on object detection technique specifically tailored for autonomous vehicles. The algorithm YOLOv5 combines speed, accuracy, and efficiency, allowing real-time detection of various objects in complex and dynamic driving scenarios. Its deep learning-based approach, leveraging convolutional neural networks, enables accurate identification and tracking of objects, including vehicles, pedestrians, and traffic signs. Experimental results showcasing the performance of YOLOv5 on benchmark object detection datasets, including its accuracy, speed, and real-time applicability demonstrate that YOLOv5 achieves state-of-the-art object detection results. The transfer learning capabilities of YOLOv5 reduce training time and resource requirements, making it adaptable to different detection requirements and datasets. Additionally, YOLOv5's active development, cross-platform compatibility, and strong community support ensure ongoing improvements and compatibility with the latest advancements in deep learning frameworks.

8.16. Dinh Cong Tung, Mai Van Linh, Dimitar Borisov, Research and Application of Deep Learning Models for Detecting Brain Abnormalities Based on CT Images, Computer Science and Interdisciplinary Research Journal, Volume 1, Issue 2, 2024, ISSN: 3033-1218, DOI: 10.70862/CSIR.2024.0102-06.

Abstract:
The paper is in the scientific thematic field I.3. This paper studies a method to improve the accuracy of a deep learning model for detecting brain abnormalities based on computed tomography images. The process begins with image preprocessing using the Histogram Equation algorithm and Gabor filter. Then, features are extracted from the fully connected layer of the AlexNet model. To optimize feature extraction, we use the Mutual Information Feature Selection algorithm to identify the most important features. Finally, the Support Vector Machine machine learning model is deployed to detect

brain abnormalities. To confirm the effectiveness of the proposed model, we compare it with other popular deep learning models, including AlexNet. Experimental results show that our method achieves an accuracy of over 93%, higher than pure deep learning models.

III. SCIENTIFIC CONTRIBUTIONS

The main scientific and applied scientific contributions described in publications submitted for this competition are the following:

III.1. New combined methods with accelerated convergence for optimization based on the dichotomy, the golden section and the Kiefer-Jonson method are proposed and 6 combined new methods are proposed, which are tested with 6 test functions of varying complexity, which show that the new modified methods are much more effective than the classical ones and give a solution 2 to 4 times faster, depending on the size of the admissible space of the control parameters. One-dimensional methods are part of multidimensional methods and the higher the dimensionality of the optimization problem, the greater the efficiency of the new proposed methods.

III.2. A new heuristic algorithm with accelerated convergence for one-dimensional optimization in boundless space is proposed and studied. The algorithm includes the first four Fibonacci numbers and a series of third-order numbers. A comparative study with other efficient algorithms is presented. The results show that the newly proposed method has a better convergence speed.

III.3. A new stochastic random search method and an algorithm for multidimensional optimization with accelerated convergence are proposed, three new modifications of it are proposed. From the study of the proposed new algorithms with 4 objective functions, it is shown that the new methods for multidimensional optimization have much faster convergence than the classical methods for random search. The study of the new methods in comparison with the classical ones shows the advantage of the new proposed methods. The methods can be easily modified for problems with functional constraints and for equality type. The newly proposed method is universal and with a small modification can be applied to ridge type objective functions, as well as for searching for a global extremum of many extremal problems using a search from multiple random starting points.

III.4. A new accelerated algorithm for multidimensional optimization for complex ridge objective functions is proposed. The main goal is to combine the advantages of the method for random search from multiple random directions with a constant step for searching for the extremum of unimodal functions and the advantages of the Gelfand and Tsetlin method. Based on a comparative analysis, it is proven that the proposed algorithm gives 2 to 4 times faster convergence compared to the classical Gelfand and Tsetlin algorithm.

III.5. A new accelerated algorithm for global optimization based on Price's method is proposed. In the new method, groups of pairs of points are created, on the basis of which new points are calculated that replace the worst ones. In the presented new method, as well as in Price's method, the values of the worst result are constantly improved and thus the points begin to be condensed around the global maximum. A comparative analysis was made with 12 multi-extremal functions. In the study of the new 4 methods with accelerated convergence when searching for a global extremum, MGO_3 and MGO_4 can be indicated as the most effective, which are more

effective than MGO_1 and MGO_2 in all multi-extremal tests. The speed of convergence to the solution of the new proposed methods and algorithms significantly exceeds the speed of convergence of the best known Price's method to date.

III.6. New fractional-rational generalized strategies for finding optimal decisions with and without the use of weighting coefficients are proposed. The proposed strategies are studied with real technological examples. Results are presented and leading solutions are recommended. In multi-criteria optimization, the choice of the compromise solution is most strongly influenced by the type of generalized strategy, the type of compromise solution satisfying the experts, and the determination of the most desired (recommended) value. The range of variation is the largest and, accordingly, the greatest sensitivity is with the generalized fractional-rational mean harmonic strategy for making a rational decision.

III.7. A method to improve the accuracy of a deep learning model for fire detection by pre-processing images collected by cameras is proposed. Experimental results show that the accuracy of the proposed model in this paper reaches over 92%, which is higher than other deep learning models.

III.8. An object detection technique specifically designed for autonomous vehicles based on YOLOv5 is studied. The experimental results demonstrating the performance of YOLOv5 on reference object detection datasets, including its accuracy, speed, and real-time applicability, demonstrate that YOLOv5 achieves state-of-the-art object detection results.

III.9. A method for improving the accuracy of a deep learning model for detecting brain anomalies based on computed tomography images has been studied. The experimental results show that the presented method achieves high accuracy.