Analysis of Landscape Architecture Planning and Design under the Background of Multimedia Based on Swarm Intelligence Optimization Path Algorithm

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The design of landscape architecture has benefited from the increased convenience and impact of computer technology. This research proposes a multimedia-based approach to landscaping design grounded on the swarm intelligence optimization (SIO) computation methodology. The procedure of composing involves first creating the landscape architecture's surroundings, after which the presentation of the landscape design in the fundamentally traditional multimedia context is contrasted and examined, and in the interim, updated techniques are offered. Accuracy and Signal-to-noise Ratio (SNR) were used as parameters to compare the iteration count for the proposed and traditional methods. The experimental findings demonstrate that the swarm intelligent optimization path calculation approach can meet landscape architectural design and planning criteria and has a shorter path length compared to the conventional approach of computation and management.

Povzetek: Raziskava predstavlja metodo načrtovanja krajinske arhitekture, ki temelji na optimizaciji poti s pomočjo rojev inteligence in multimedijskih pristopov, kar izboljša natančnost in učinkovitost oblikovanja.

1 Introduction

In the past, landscape gardening planning and design were refined by the accumulation of designers' professional expertise. Larger landscape gardening typically prioritizes the broad knowledge of architects, design hours, and creative achievement in their planning and design [1-3]. Currently, ranges of sophisticated supplementary technology are also reasonably grown up, and computer-assisted functions are growing more and more sophisticated. Human development and intellectual development are two benefits of using computer-assisted capabilities for landscape architectural planning and designing. Digital design using computers can be more beneficial, precise, effective, and scientific than previously published experience-based designs [4-6]. By leveraging decentralized control, emergent behaviors, and adaptive responses stimulated utilizing natural systems, swarm intelligence gives innovative solutions for designing and dealing with landscapes. These standards enable the advent of environments that self-prepare, optimize useful resource use, and adapt to converting situations, promoting resilience and sustainability [7-8]. The interdisciplinary nature of swarm intelligence fosters a holistic method of landscape design, integrating ecological, aesthetic, and practical considerations to enhance the nice performance of urban spaces, parks, and natural habitats. Through those principles, swarm intelligence is now not the most effective and enriches innovative methods in landscape architecture however also aligns with the vital of harmonizing human interventions with herbal ecosystems [9-10]. The study and development of logical processes have emerged as the primary area of focus in this topic, as the design techniques for computer-assisted computation techniques are currently maturing. The selection of scenic environments is done using parametric techniques, which offer a valuable supply of data. Based on the above-mentioned research data, the swarm intelligence optimization computation technique proposed in this paper in a multifaceted setting is used in the design planning of landscape architecture. The route selection of scenic roads has been proved by experiments to be more precise and effective than conventional computation techniques.

2 Related works

The goal of the research [11] was to design Dapo Town's shoreline landscape used the fundamental ideas of landscape ecology. The goal was to establish ecological equilibrium in planning, highlight ecosystems, and create an integrative landscape ecological setting that would benefit both humans and wildlife. The design enhanced the natural surroundings, which encouraged a healthy coexistence among nature and human beings, enhanced the city's physical layout and contributing to temperature and environmental regulation. It also blended synthetic and natural components.

Study [12] offered a fresh approach to the long-term solution of environmental contamination by fused DL-DNN with landscape architecture. When there were green plants inside and outside the home, the levels of carbon dioxide were continuously monitored. Conversely, plants eliminate pollutants from the atmosphere, facilitated the preservation of a wholesome atmosphere. The data model may be assessed and evaluated used web 4.0, which is based on human-centered artificial intelligence. The results of the study could be incorporated back into the design phase for additional refinement and enhancement.

The work outlined [13] a three-step process for used advanced machine learning technologies to enhance cultural heritage decision-making, image grammetry, feature extraction, and discriminative feature analytics. Small dataset feature extraction was aided by the application of Sparse-Learning-Modeling (SLM). The 3D point cloud models of 13 cultural sites were successfully used to test the proposed method, and the results might be repeated in other heritage sites with unique Cultural DNA around the world. The research's conclusions could broaden the conversation about used cutting-edge AI and digital tools in heritage landscape design.

Study [14] a novel and entirely automatic method for creating as-built CAD landscape architecture (LA) drawings utilized drone scanning to obtain three-dimensional (3D) reality data, camera, and LiDAR was presented. Began with the complete process, reality data was transformed into 2D feature images for ortho-images and elevation-maps. For image pixel wise segmentation, an automatic site surface categorization, object recognition, and ground point of control recognition system was developed using deep learning, and its performance was compared against the binary segmented model U-Net.

Research [15] investigated three machine learning approaches: multilayer perceptron (MLP), neural network with radial basis function (RBFNN), and support vector machine (SVM) that were used for the visual appeal simulations of areas of forests in order to assess the environment's decorative quality using a method based on humans perceive it. To implement the approach, 72 Hyrcanian broad-leaved forest landscapes' 13 landscape traits were identified. Using machine learning approaches, the aesthetic quality model of landscapes was created to identify their visual attributes.

Study [16] suggested generated zooming animations with machine learning help to streamline the designer's workflow and optimize energy use. Using Vector Quantified Generative Adversarial Networks and Contrastive Language-Image for Deep Learning Alternative landscape designs was created using text prompts based on pre-training, and they were then assembled in an animation. According to their investigation, generated a single frame took approximately 3.636 ± 0.089 s, which was far faster than the traditional animation creation process. Additionally, their approach produced a high-quality image with an inception score evaluation of 3.2904.

Study [17] investigated a novel artificial intelligence (AI) comprehends the characteristics of designs. Given that landscape architecture could profit from the new opportunities presented by AI technology, the subject was crucial and urgent. The primary technique used in the research to create and evaluated landscape architecture designs was Style GAN. To produce high-quality, high-resolution, and diversified images. The study conclusion that AI systems were able to recognize and extract certain high-dimensional design traits from landscape architecture schemes, included semantic-rich design elements in addition to image morphology.

Article [18] proposed to serve as a catalyst for a critical conceptual conversation at the upcoming DLA symposium in 2023 around the pedagogic foci for learning about digital landscape design.

The article [19] discussed about to use it for landscape design. An urban 3D landscapes model's data collection and preprocessing were discussed and examined, and a PSO (particle swarm optimization)-based landscapes design and planning model was suggested. The technique successfully enhanced the algorithm's efficiency as well as the velocity and 3D presentation effect.

Article [20] proposed an artificial intelligence (AI) algorithm-based the optimization system to simulate the spatial pattern of a garden landscape. It then used an artificial neural network (ANN) to implement the image rendering process, which included polygons manufacturing, color, blanking, the brightness, and projecting, to produce an authentic landscape model and understand the 3D garden landscape's visual aesthetic. The program's accuracy in improved the spatial arrangement of a garden landscape was demonstrated by the test outcome, which outperform a traditional optimization method based on the SVM technique by over 20%. Table 1 shows the summary of related works.

Table 1: Related works

References	Key findings	Limitations
[11]	Designed Dapo Town's shoreline landscape used landscape ecology concepts. Established ecological equilibrium and included ecosystems. Enhanced town layout and environmental regulation. Blended synthetic and herbal additives.	Lack of quantitative ecological effect evaluation. Challenges in long-time period sustainability of ecological equilibrium. Limited scalability to distinctive geographical contexts.
[12]	Fused DL-DNN with landscape architecture to reveal CO2 tiers with green flora. Utilized internet 4.0 for statistics modeled and human-targeted AI. Incorporated outcomes into layout refinement.	Dependency on particular environmental conditions. Potential bias in localized data series. Generalizability to numerous environmental settings.
[13]	Used advanced system getting to know for cultural historical past decision-making. Applied Sparse-Learning-Modeling (SLM) for small dataset function extraction. Tested on 3-d factor cloud models of cultural sites. Potential for huge utility in background landscape design.	Reliance on availability and satisfactory of 3-d factor cloud records. Computational complexity in real-time characteristic extraction. Limited applicability to non-cultural heritage landscapes.
[14]	Developed automatic CAD drawing method for landscape architecture the usage of drone and LiDAR information. Applied deep learning for web page category and item detection. Compared overall performance with U-Net version.	Dependency on first rate drone and LiDAR data. Challenges in real-international deployment because of website variability. Processing time constraints for massive-scale projects.
[15]	Applied SVM, RBFNN, and MLP for cultured exceptional simulation in wooded area landscapes. Defined thirteen panoramas' attributes for visual evaluation. Created device getting to know version for cultured attribute identification.	Subjectivity in human perception-based reviews. Limited capture of cultural and emotional aesthetic options. Transferability troubles to non-woodland panorama types.
[16]	Used device studied for producing zooming animations in landscape design. Employed Vector Quantified Generative Adversarial Networks and Contrastive Language-Image for animation creation. Faster animation advent compared to conventional methods. Produced awesome snap shots with inception score.	Potential exchange-offs in picture excellent in comparison to guide layout. Dependency on pre-training and text-based totally prompts for variant. Limited exploration of user interaction in animation customization.
[17]	Applied Style GAN for AI-assisted layout trait popularity in panorama architecture. Generated high-decision, various layout photos. Identified semantic-rich layout elements. Potential for reinforcing design creativity and efficiency	Challenges in goal definition and extraction of layout traits. Ethical concerns in AI's function in innovative techniques. Interpretability issues in AI-generated designs
[18]	Initiated discourse on virtual panorama layout education for international warming disaster. Focused on production strategies, gear, and methodologies. Positioned for vital discussion at DLA symposium	Limited scope confined to instructional components. Potential bias in conference representation. Limited actionable effects past academic discourse
[19]	Discussed PSO-primarily based landscapes layout and making plans model for city 3-d landscapes. Enhanced algorithm performance and 3-D presentation. Suggested enhancements in landscapes design and making plans	Dependency on parameter tuning and convergence in PSO. Generalizability challenges to complicated urban environments. Integration issues with present urban planning frameworks.
[20]	Developed AI algorithm-based totally optimization gadget for lawn panorama spatial styles. Implemented ANN for picture rendering	Sensitivity to parameter settings and dataset characteristics in ANN. Balancing aesthetic choices with ecological concerns. Scalability

	and aesthetic enhancement. Demonstrated accuracy improvement over conventional SVM techniques.	limitations in coping with large-scale panorama designs.

3. A Landscape environment route selection model

3.1 Make a conceptual map of a landscape garden.

To create an architectural map of architectural landscape design, use the planning process of a portion of a hilly beautiful location in the province capital. It is 500 meters in size. The black polygon in the 5000m rectangular stands in for several scenic locations within the scenic region that are considered to be obstruction areas.

If the border is WSB, the outdoor atmosphere is W, and all of the polygon barriers regions in the region are Q_i , then: $W = \{WSB, Q_1, Q_2, \cdots, Q_m\}$

Where m. is the number of barrier regions that are polygon Q_i , which can be expressed as: $Q_i = \{x_1 y_1, x_2 y_2, \cdots, x_n y_n\}$

Where the total number of vertex in the polygon impediment region is denoted by n Q_i ; $x_n y_n$ is the coordinate of the nth vertex.

3.2 Method for organizing and creating architectural landscapes with a multimedia setting

Only in the context of environment spaces can the investigation of the visual environment be useful [21-23]. From the standpoint of viewpoints, the human eye's natural range of perception is 60, and the brain is not malleable. Because of the visual cues that the bread provides, the angled corn appears intuitively sturdy. The landscape's interior and exterior visual spaces intersect. Is an individual material's spatially visible interaction identical to its physical space? This primarily depends on how people's viewpoints and line of sight relate to the dimension ratio of the outdoor space's perimeter. Multimedia factors, inclusive of snapshots, films, interactive maps, augmented reality (AR), and virtual fact (VR), are incorporated into the landscape planning system to beautify visualization, engagement, and communication. High-decision pix are used to give designated views of landscape designs, plant species, and environmental capabilities. These pix help stakeholders and the public to higher understand and visualize the proposed designs. Videos showcasing 3D renderings, walkthroughs, and flyovers of the panorama designs offer a dynamic view of the deliberate areas. This allows for a more immersive reveal in, enabling viewers to understand the spatial and aesthetic features of the layout. These maps allow customers to explore exclusive aspects of the landscape design interactively. Features include zooming, panning, and clicking on unique regions to get greater information to enhance consumer engagement and knowledge of the layout.

The bidirectional, acyclic graph in the multimodal backgrounds used for landscape design shows how variables depend on probability. Under the multimedia backdrop of sample learning, the field of landscape planning embodies a set of assumptions regarding conditional independence. Rather than the death of the progeny, any end endpoint is the merged state of each parent independently. The distribution of probabilities of each node's randomized vector can be predicted by the quality of multimodal imagery, and it can be broken down into the mean of the mean random component distribution, namely

$$P(x_1, x_2, \cdots x_m | B) = \prod_{i=1}^{N} P(x_j | \pi_i) = \frac{\sum_{A-(x_j)\cup x_j} P(x_1, x_2, \cdots x_m)}{\sum_{x_i} P(x_1, x_2, \cdots x_m)}$$

(1)

Where: $x_1, x_2, \cdots x_m$ - characteristic node, $A = \{x_1, \cdots x_m\}$ - set of attributes, $\pi_i : i = 1, 2, \cdots, m$ symbolizes the node's parent node set xi.

In the environment of multimedia content, the key aspect of landscape development is estimating the potential of generating leads according to the appearance of events. In addition, mathematical expertise in landscape design in the context of digital media is applied to determine the probable occurring events that correspond to associated nodes. This allows for the development of landscape construction supported by the node's continuing variables (probability distribution). In other words, the problem lies in one of the attribute sets H and K of the characteristic set A has been determined to have an amount of h, while the other characteristic set K of the characteristic set A is a conditional likelihood P of the specified value k. K=kH=h. It is possible to determine the most likely outcome or cause in landscape design within the framework of audiovisual by contrasting the sizes of P(K=k|H=h) of various nodes.

The primary basis for landscape design in a multimedia context is the greatest prior probability, which is used to derive the event hypotheses given predetermined circumstances. The Sample space D defines the restricted space of hypothesis H. Each multimodal background's environment organizing, or assumption h, has a post-probability that may be stated in D for the network's configuration as:

$$P(h|D)=\frac{P(D|h)P(h)}{P(D)} \quad (2)$$

The goal of landscape design for architecture in a multimodal environment is to achieve

$$h_{MAP}=\arg\max_{h\in H} P(h|D) \quad (3)$$

The shortest possible explanation L (g, D) is a metric to show the landscape design plans' storing structure data against a multimedia backdrop. The lowest descriptive length L of the framework's construction g on the data set D is represented by one of the representations of G, which is the whole potential architectural space of a Bayesian network.

4 Planning and designing landscapes against the multimedia background

4.1 Swarm intelligence algorithm

A swarm intelligence algorithm is adopted to improve the landscape planning method under the multimedia background. The specific swarm intelligence algorithm is a typical ant colony method [24-26]. The initiate value of the ant colony technique is the initial path optimization that is derived from the path planning method. Different nodes of the initial path are set at points S, P1, P2, etc... Pi1 symbolizes the route selection line segment's starting node, Pi2 represents each route selection line segment's terminal node, and any point within it can be stated using the following formula.

$$P_i(h_i)=P_{i1}+(P_{i2}-P_{i1})\times h_i, h_i\in[0,1], i=1,2,\cdots \quad (4)$$

Then, the distance along the path from point of origin S to destination point T can be stated as:

$$L=\left\{S,P_1(h_1)+\sum_{i=1}^{d-1} length\{P_i(h_i),P_{i+1}(h_{i+1})+P_d(h_d)\cdots\}\right\}$$

(5)

Paths of varying lengths can be represented by various combinations. Finding the right value is hence the challenge in determining the optimal path throughout the ant colony algorithm. Suppose there are R ants in the ant colony, and the components that need to be optimized are D, D_{φ_i} which represents its $i(1\le i\le n)$ element. The variable to be optimized is $h_1,h_2,\cdots,h_d$, and the number is n.

$$k\left(\zeta_j^t\left(D_{\varphi_i}\right)\right)=\zeta_j\left(D_{\varphi_i}\right)\Big/\sum_{i=1}^{n}\zeta_j\left(D_{\varphi_i}\right) \quad (6)$$

Where, $k\left(\zeta_j^t\left(D_{\varphi_i}\right)\right)$ are The probabilities that the t-th ant will judge various calculated values.

The ant search adjustment method is:

$$\zeta_j\left(D_{\varphi_i}\right)(t+\Delta)=\zeta_j\left(D_{\varphi_i}\right)(t)+\Delta\zeta_j\left(D_{\varphi_i}\right) (7)$$

The expression $\Delta\zeta_j\left(D_{\varphi_i}\right)$ shows the aggregate amount of information items that the ant still needs to pass through to reach all elements φ_i. The following is the computation technique

$$\Delta\zeta_j\left(D_{\varphi_i}\right)=\sum_{k}^{R}\Delta\zeta_j^k\left(D_{\varphi_i}\right) \quad (8)$$

Continue the same procedure until all ants have obtained a unique element or until the maximum number of repetitions permitted, that is, the improve $h_1,h_2,\cdots,h_d$ ment is acquired. Table 2 shows the parameters and Their Ranges for the Ant Colony Optimization Algorithm.

Table 2: Parameters and their ranges for the ant colony optimization algorithm

Parameter	Range
τ_0	$0.1-1.0$
ρ	$0.1-0.9$
α	$1-5$
β	$1-5$
R	$10-100$
D_j	$1-N$

x_j	$1-N$
Maximum iterations	$100-1000$
Local update	$\rho: 0.1-0.9$
Global update	$\Delta\tau: 0.01-1.0$
Initial pheromone concentration	$\tau 0: 0.1-1.0$
Pheromone volatilization coefficient	$\rho: 0.1-0.9$
Probability calculation	$\alpha: 1-5 \beta: 1-5$
Heuristic information	N/A

- **Maximum iterations**: Determines how often the algorithm will run, balancing computational time and answer high-quality.
- **Local update:** Updates pheromone levels after every ant's excursion, making sure the neighborhood seeks intensification.
- **Global update:** Updates pheromone ranges in any case ant's entire their tours, making sure global exploration.
- **Initial pheromone concentration:** Sets the starting pheromone degree to avoid bias and manual the initial seek.
- **Pheromone volatilization coefficient (ρ):** Controls the rate at which pheromone evaporates, balancing between exploration and exploitation.
- **Probability calculation:** Determines the probability of selecting a selected direction based totally on pheromone and heuristic records.
- **Heuristic information:** Provides additional guidance based totally on hassle-precise know-how, improving the set of rules performance.

4.2 Updating the concentration of pheromones

Pheromone volatilization occurs in tandem with the ant colony's exploring process throughout time, so the pheromone information on the path needs to be updated reasonably.

$$\tau_{ij}(t+1)=(1-\rho)\tau_{ij}(t)+\rho\tau_0 \quad (9)$$

In the formula: τ_0 is the starting concentration for pheromones; ρ stands for the coefficient of pheromones volatilization.

The rule for updating global pheromones is

$$\tau_{ij}(t+1)=(1-\rho)\tau_{ij}(t)+\rho\Delta\tau_{i,j}(t) \quad (10)$$

$$\Delta\tau_{i,j}(t)=1/L_b \quad (11)$$

Where, L_b is the length of the best path.

4.3 Innovative Landscape architecture is characterized by planning and design

The landscape architectural plan should adhere to specific artistic guidelines and prioritize innovation in addition to expressing rationale. One aspect of it is the connection between unity and diversity [27–29]. Diversity in landscape design refers to the consideration of all the materials mentioned above when creating the form, the garden's amount, color, line, shape, style, and other components. This allows the materials to work together harmoniously and cohesively to create a sense of consistency or similarity that gives the impression of a shift in unity. Inadequate ideas for the components of the design indicate that something will need to be altered. It created an impression of chaos and disarray in these circumstances. Second, the connection between comparison and coordination is understood. To produce objects of various forms with the goal of overall harmony, landscape architecture is formed by utilizing and experimenting with shape, color, line, proportions, and both real and imagined circumstances, darkness, etc. connected to several settings. The relationship between equilibrium and stability is the third. The color of the landscaping design is being developed, and if the color is heavy, it will look untidy. Quantity is another important consideration. It won't be organized if it is too big. The concept of balancing states that it can only be stable when a sensible utilizing plant arrangement with varying weights creates a pleasant feeling. The connection between rhythm and rhythm is the fourth. Plants' forms, hues, and textures can convey the rhythm and cadence of their surroundings. The willow trees should be humorous and exacting, considering regularity and mood as well as the effect that best suits the area. To strengthen the rhythm, greenery is organized in an alternating pattern.

The key feature of the architecture of the landscape is not the paving; rather, it is the synchronization with the irrational area, which makes each place more distinct. The surroundings are emphasized by the use of shape and pattern, which heightens the sense of solidity in the landscape design. Neutral colors are used extensively in decorating. The colors are vivid and not garish, but in general, the opulent hues ought to harmonize with the landscape architecture space's ambiance, as the visual sense is employed to amplify the space's sense of openness and direction.

The finishing touches, such as the lighting fixtures, chairs at flower stands, plants, rocks, flower pots, and springtime hangings over flower beds, are what define the landscape architecture's centerpiece. The sculpture's decoration meets people's psychological and bodily needs. The little garden accents both divide and unite the area, providing clear signage for the picturesque locations. The ornaments accentuate the scenery that passes through the memorial garden. The entire ambiance of the landscape gardens demonstrates a singular creative idea. Exploration, yearning, and other creative ideas.

4.4 The logical approach to planning and designing landscape architecture

The conceptualization of a landscape architectural plan follows a specific concept that permeates the entire process, from ideation to idea integration, understanding the design direction of the field, and incorporating the design idea into each aspect of the plan, with the directing philosophy acting as the design's central idea. As long as you create landscape architecture pieces that satisfy the desires of individuals as long as you understand the underlying ideology. Contemporary landscape architecture is growing more and more intricate in its design. This has to do with making people's appearances better. Living in a place demands a range of activities. In the design, people's actions must be taken into account, but the function itself must also be given careful consideration. The commemorative garden's landscape design requires more than just a quadratic element; to accommodate people's activities, it also needs to have a multidimensional, stereoscopic exhibition environmental space capacity [30-31].

The fundamentals of both domestic and international landscaping design are constantly followed in scientific and thorough study and research. This primarily depends on how both environmental planning and architectural design are socially acceptable. Various building operations are planned through rational investigation and examination of scientific landscape design plans, and the data gathered from multiple facets is used effectively to analyze the condition on the spot to comprehend public opinion. The design of landscapes of the remembrance gardens can be rendered more mathematical and the unification of history and future realized by looking into local languages and environment. As an intricate system undertaking, In landscape architecture, it is necessary for scientific and appropriate design and planning, ongoing examination of the various phases of each system's assistance, theme clarification, extensive study to solve examination problems, grasping of the main inconsistencies, and a bird's-eye view of the enemy to make the proper strategic application of the landscape design plan and steer its healthy advancement in the right guidance. A plan selection based on advantages and contrasting approaches must be made to honor the landscaping design in the garden. Argumentation will be crucial if you want to explore creativity and novel concepts through the lens of the future.

4.5 Planning and designing landscape architecture through the application and development of the swarm intelligent optimisation path method

It also shows that individuals are progressively pursuing better criteria for the standards of the landscape design sector and the added value of landscaping architectural products. The landscape architectural industry has grown to become a requirement in people's lives. Works are intended in the form of creative motivation and assistance, increasing the means of communication associated with a city landscape garden tradition and providing consumers with a pleasant shopping experience. They are backed by artistic expressions of urban landscape gardens and various media data image theories.

4.6 Using swarm intelligence optimization path algorithm for landscape architecture design in the multimedia environment

A two-dimensional plane system serves as the source channel for the swarm intelligence optimization path method. Maps, photos, documents, and advertisements fall within this category. The static data graphics model is still a conventional way to express ideas, particularly in this day of modern technology. To bring the innovative pieces of urban landscape gardening culture to life, more inventive elements must be added. For instance, Emperor Yongzheng's history during the Qing Dynasty served as the inspiration for the Beijing Palace Museum's design. I adore a character like that. The delivery of this inventive fan depends on simple text, to streamline the text factors, expressing the form, characteristics of the content, technical manufacturing, and consumer demand of cultural artistic creations, creating a brand image, and educating consumers about the historical progression and product attributes of Yongzheng during the Qing Dynasty through the fan's style. Ultimately, the fan is intended to convey the Qing Dynasty.

Meanwhile, under the guidance of Changsha, the throw pillow work on the urban landscape and garden culture shows that Changsha's famous scenic spot and geographical indication. It is interpreted through static graphic theory, simple and clear lines, and bright colors are used to bring out the charm of the landscape city of Changsha, allowing customers to associate and resonate with urban culture, which makes the spread of urban landscape and garden culture more widespread and attract more tourists to like this landscape city Changsha. The swarm intelligence optimization path algorithm's dynamic and static states are not strictly segregated. It is possible to transform the dynamic swarm intelligent optimization path method using the swarm intelligent optimization path method. For instance, in the author's universe, a case of creating a dialect cultural mask based on the Changsha dialect. The Changsha dialect passed by verbal recommendations takes the place of the mobile dynamic data dissemination method with the swarm intelligence optimization path algorithm, which is expressed through creation, and the phonetic form of the dialect is used to explain the ideas in the dialect and interesting activities for learning dialects are developed, the way that learning a dialect becomes enjoyable, easy, and even expressive. It enables guests to enjoy the fascinating world of landscaping design while also learning about Changsha's past and the local population's customs.

It is vital to include the products that tourists find most appealing during the production process, and the page H5 design concept is employed to enhance the Changsha dialect's uniqueness and cultural identity. To enhance the vividness of dialect communication, online graphics are used. This is the message that dialect culture genuinely wishes to send to visitors, not just the outcome of doing so to a certain degree. Concepts for static and dynamic information graphics can be transformed, or even merged, to increase the penetration and impact of urban cultural interaction and facilitate a wider dissemination.

4.7 Planning and designing landscapes against the multimedia background

In the era of the Internet, information is disseminated widely while also changing quite quickly. More design and communication tools are needed for today's landscape garden culture production items. The background of website promotion is the graphic philosophy of distributing knowledge, and the primary content is the user- interface layout for mobile devices. Viewers are presented with a distinct sense of sight when cultural legacy is acknowledged and assimilated. Under the framework of urban landscape architectural culture, this operation significantly raises the brand value and manufacturing excellence of Architecture of urban landscapes. Information on complex and varied Architects of urban landscapes can be incorporated into the design and disseminated through a variety of media. Innovative APP websites are currently used to spread landscape outdoor space creative and cultural goods through the customer aesthetically insights and easy payment methods. Later on, networking applications and technological positioning websites can be utilized for enabling those cultural and imaginative goods to continue providing value-added services, assisting tourists in communicating with and understanding the landscape cities. Visitors are the ones who value the cultural qualities of imaginative urban landscape goods and the delight of thoughtful, customized landscape design. The Internet blends artistic and urban landscape design and cultural products, and it employs a novel approach to disseminate landscape architectural arranging and creating in a multimodal environment. The preparation and creation of landscape architecture against a multimedia backdrop is becoming more difficult and innovative due to the quickening pace of economic development.

5 Simulation test and analysis of outcomes

5.1 Experimental environment

We conducted a simulation experiment to validate the suggested swarm intelligent optimisation path technique under the context of multimedia environment in this work. Hardware environmental simulation: Intel® quad-core i7 2.8GHz quad-core CPU, 8GB RAM. Matlab 7.0 simulation software along with the Windows 7 system operating system comprise the simulated software environment.

5.2 A sample search path for an ant colony

Figure 1 provides an instance of path search using the ant colony technique, assuming there are 30 groups and a starting concentration of 0.2 informational elements. At time t, every ant exits the body with a pheromone’s concentration of 1. An ant colony's path of travel is randomly selected when there is no pheromone present on it.

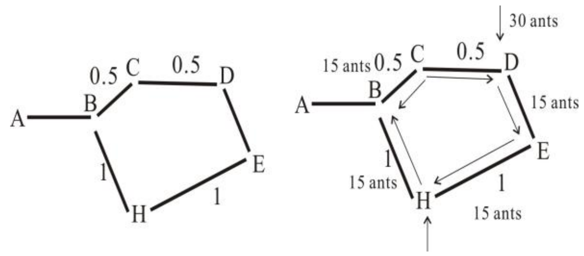

Figure 1: A sample search path found in an ant colony

5.2 Performance comparison

To confirm the effectiveness of the method suggested in this study, under the same environmental conditions, the algorithm in this paper has been compared with the traditional path planning algorithm. Table 3 displays the ideal programming lengths that were determined using two distinct techniques. Table 3 shows that the total length of the predicted path obtained by this technique is shorter than that of the traditional algorithm. The route selecting line produced by the swarm intelligence's optimal route technique is the smallest when the circumstances match the physical features of the landscape garden, demonstrating the effectiveness and scientific nature of the route design. The interaction between humans’ environments and nature is a major discipline in the field of landscape design and planning.

Its meaning and scope have evolved throughout history. Relevant material has been added to a broader category in addition to the typical shelters towering structures, mountains, rocks, water, and wooden construction techniques. From landscape design to landscape architect is the name of the discipline that describes how the profession of landscape architectural is extended and tolerated. Throughout the history of creating gardens and gardening, the profession of landscape architecture has always focused on the fundamental elements of design: artistic and cultural endeavors. The qualities of creating gardens are emphasized by Terms like "depending on nature, surpassing nature," "the synthesis of architecture splendour and natural beauty," "the sense of poetry and artwork," alongside "the significance of artistic concept." Philosophically speaking, these phrases represent the "oneness between nature and man." One type is the subject of the enlarged center of the garden design, which focuses on the harmony between man and nature. A feature that is suggestive of pure design concepts, architecture, gardens, poetry, or painting frequently ignores certain design processes, particularly the portion of that utilizes computerized design technology.

Table 3: Outcomes of route preparation are compared

Method	Typical path/m	Typical quantity of repetitions
Conventional method for path planning	23345	404
This paper's algorithm	18033	323

5.3 Statistical analysis

In this paper we used SPSS analysis in that ANOVA and Chi-squared are used to test the data. The practice of using quantitative techniques to search for associations, connections, and trends in data is known as statistical analysis. Further study aspects may be predicted with the help of analysis of statistics. If one understands statistics, they can collect data using the best methods, perform sufficient analysis, and effectively explain the findings. The research also makes use of statistical analysis, as demonstrated in Table 3, to estimate future requests and deeper comprehend the findings. Table 3 shows the value of statistical analysis.

Chi-Squares: The p-value of 0.0004 indicates a significant difference in path lengths between the traditional path planning algorithm and the swarm intelligence algorithm proposed in this study.
ANNOVA: The p-value of 0.0006 and f-statistics of 10.987 suggest significant variance in average path lengths obtained by the two algorithms, supporting the superiority of the swarm intelligence algorithm.

5.4 Accuracy and SNR

The accuracy and signal-to-noise ratio (SNR) of the suggested Swarm intelligent approach are contrasted with those of the conventional methodology. The resulting results are shown in Figure 2 and 3. In comparison with the traditional approach; the suggested approach improved the resultant signal-to-noise ratio by 110 (dB). The accuracy value attained with the suggested method is 98% higher than with the conventional approach. The results show how feasible the suggested strategy appears. Table 4 shows the result of comparison.

Table 3: The value of statistical analysis

Methods	Chi-square	ANNOVA
P-value	0.0004	0.0006
F-stats	11.234	10.987

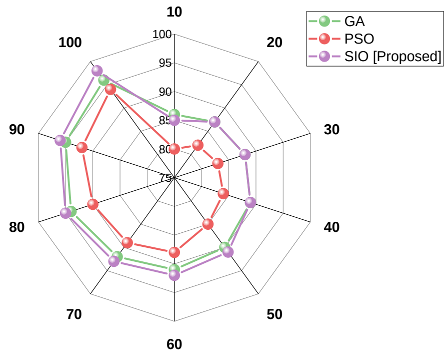

Figure 2: Outcome of accuracy

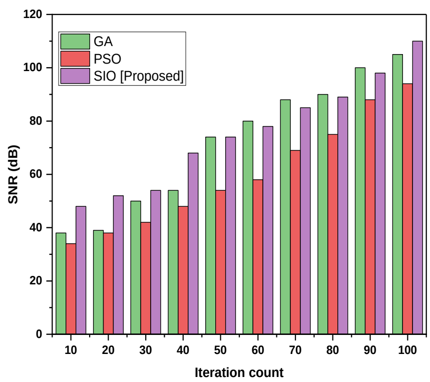

Figure 3: Performance of SNR

Table 4: Result of comparison

Method	Accuracy (%)	SNR (dB)
PSO	94	94
GA	96	105
SIO [Proposed]	98	110

5 Discussion

The following are the limitation occurs in existing works: Lacking an ecological impact analysis that is quantifiable. Causes that threaten the ecological balance's long-term sustainability. Limited capacity to scale to different geographic situations. Reliance on specific environmental factors. Possible partiality in regionalized data sets. Adaptability to a wide range of environmental conditions. Reliance on 3-D factor cloud recordings being adequate and available. Complexity of computation in extracting characteristics in real time. Limited application to landscapes with no cultural heritage. Dependence on superior LiDAR and drone data. Challenges arising from website variability in real-world international implementation. Processing time limits for large-scale undertakings. Subjectivity in reviews based on human perspective. Restricted representation of visual and emotional cultural possibilities. Issues with transferability to non-woodland landscape types. Potential trade-offs between the guide arrangement and the picture are good. Pre-training and text-based prompts exclusively are required for variation. User interaction with customized animations has not been thoroughly explored. Dependency on parameter tuning and convergence in PSO. Generalizability challenges to complicated urban environments. Integration issues with present urban planning frameworks. Sensitivity to parameter settings and dataset characteristics in ANN. Balancing aesthetic choices with ecological concerns. Scalability limitations in coping with large-scale panorama designs. PSO can converge in advance to nearby optima, specifically in complicated or multimodal optimization landscapes. It may additionally warfare to explore diverse areas of the hunt space efficiently after initial exploration. Performance intimately is based on the selection and alertness of crossover and mutation operators, which would not be finest for all hassle domain names. Similar to PSO, GA also can converge in advance, mainly in high-dimensional or rugged landscapes.

To overcome this limitation, this research proposes a multimedia-based approach to landscaping design grounded on the swarm intelligence optimization (SIO) algorithm. Adaptive and various techniques can enhance robustness in opposition to premature convergence and nearby optima trapping. Potential scalability enhancements due to decentralized choice-making and coordination mechanisms among swarms or marketers. Capability to handle diverse trouble types and constraints efficaciously via incorporated studying and optimization processes. By addressing these limitations and leveraging ideas from numerous swarm intelligence paradigms, SIO ambitions to provide a more versatile and powerful optimization framework suitable for complex and dynamic optimization scenarios.

6 Conclusions

The design of landscape architecture has benefited from increased convenience and impact from technology for computers. This research proposes a multimedia-based approach to landscaping design based on the swarm intelligence optimization computation technique.

The process of composing involves first creating the landscape architecture's circumstances, after which the analysis of the landscape design in the fundamentally traditional multimodal context is contrasted and examined, and in the interim, updated techniques are offered. Only when landscape dimension is assumed can the study of the visible landscape have any practical use. In the context of multimedia content, swarm intelligence algorithms are used to enhance the landscape planning process. The experimental results demonstrate that the swarm intelligence optimisation path computation approach can meet architectural landscape design and planning criteria and has a shorter path length compared than the conventional process of measurement and planning. The fulfillment of the swarm intelligence algorithm can be highly dependent on the preliminary situations and parameters set at the beginning. Poor initial values may additionally result in suboptimal answers. The set of rules may also face demanding situations in scaling correctly with the growing length of the landscape and the number of factors concerned in the design system.

Future scope: Future research may want to awareness on developing more advanced and green swarm intelligence algorithms that lessen computational complexity and enhance scalability. Hybrid procedures combining more than one optimization strategies may be explored. Enhancing the algorithm to evolve and re-optimize paths in real-time as environmental situations change or new facts becomes available could make it extra sensible for dynamic programs. As technology advances, incorporating more state-of-the-art multimedia elements including augmented reality (AR) and virtual reality (VR) should offer greater immersive and interactive design studies.

Data availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of interest

The authors declare no conflicts of interest.

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References

[1] Hussain, S. , & Said, I. . (2015). Knowledge integration between planning and landscape architecture in contributing to a better open space. *Procedia - Social and Behavioral Sciences,* 170, 545-556.

[2] Hitter, T. , Cantor, M. , Buta, E. , & Vasiu, R. A. . (2016). Landscape architecture planning proposal for visually impaired in cluj-napoca. *Proenvironment Promediu*, 10(2), 174-183.

[3] Karyn, Bosomworth, Renae, & Walton. (2017). Innovative or unrealistic: reflections on the use of landscape architecture visualisations in climate change planning. *Australian journal of maritime & ocean affairs: AJMOA*, 9(2), 95-106.

[4] Zhou, B. , Wu, W. , & Wei, Z. . (2017). Thinking of education reform of principles of urban planning for landscape architecture. *Shanxi Architecture*.10(06), 84-88.

[5] Portman, M. E. , Natapov, A. , & Fisher-Gewirtzman, D. . (2015). To go where no man has gone before: virtual reality in architecture, landscape architecture and environmental planning. *Computers Environment & Urban Systems,* 54(1.), 376-384.

[6] Zhang, & Yong. (2015). Landscape design of city road. *Advanced Materials Research*, 1065-1069, 2753-2756..

[7] Ren, A. and Chen, Z., 2024. *Building Multimedia Interactive Landscape Design Platform Based on Genetic Algorithm.*

[8] Lipowicz-Budzyńska, A., 2024. *Multimedia In Architecture And Social Communication*. Scientific Papers of Silesian University of Technology. Organization & Management/Zeszyty Naukowe Politechniki Slaskiej. Seria Organizacji i Zarzadzanie, (193).

[9] Wang, L., 2024. Application of Computer Aided Design Technology in Landscape Design. *Advances in Computer, Signals and Systems*, 8(1), pp.81-87.

[10] Liu, Y., Fan, L. and Wang, L., 2024. Urban virtual environment landscape design and system based on PSO-BP neural network. *Scientific Reports*, 14(1), p.13747.

[11] Sangju, W.A.N.G. and Shizhen, X.I.A.O., 2024. Landscape Architecture Planning and Design Based on Landscape Ecology Theory: A Case Study of Waterfront Landscape Planning and Design of Dapo Town. *Journal of Landscape Research*, 16(1).

[12] Chen, X., 2023. Environmental landscape design and planning system based on computer vision and deep learning. *Journal of Intelligent Systems*, 32(1), p.20220092.

[13] Goodarzi, P., Ansari, M., Rahimian, F.P., Mahdavinejad, M. and Park, C., 2023. Incorporating sparse model machine learning in designing cultural heritage landscapes. *Automation in Construction*, 155, p.105058.

[14] Han, S., Jiang, Y., Huang, Y., Wang, M., Bai, Y. and Spool-White, A., 2023. Scan2drawing: use of deep learning for as-built model landscape architecture. *Journal of Construction Engineering and Management*, 149(5), p.04023027.

[15] Jahani, A., Saffariha, M. and Barzegar, P., 2023. Landscape aesthetic quality assessment of forest lands: an application of machine learning approach. *Soft computing*, 27(10), pp.6671-6686.

[16] Ardhianto, P., Santosa, Y.P., Moniaga, C., Utami, M.P., Dewi, C., Christanto, H.J. and Chen, A.P.S., 2023. Generative deep learning for visual animation in landscapes design. *Scientific Programming*, 2023(1), p.9443704.

[17] Ran, C.H.E.N. and Jing, Z.H.A.O., 2023. Generation and Design Feature Recognition of Landscape Architecture Scheme Based on Style-Based Generative Adversarial Network. *Landscape Architecture*, 30(7), pp.12-21.

[18] Fricker, P., Hayek, U.W. and Monacella, R., 2023. Digital Landscape Architecture Education–Where Do We Stand and Where Should We Go?. *Journal of Digital Landscape Architecture,* 2023(8), pp.576-584.

[19] Chen, Y., 2024. *Application of Particle Swarm Optimization Algorithms in Landscape Architecture Planning and Layout Design*.

[20] Zhang, H. and Deng, Y., 2024. Artificial Intelligence Based Garden Landscape Design System and 3D Visualization Technology.

[21] Chang, Q. , Su, W. X. , & Wang, H. . (2019). Research progress on application of landscape ecology in landscape architecture. Ying yong sheng tai xue bao = The journal of applied ecology / Zhongguo sheng tai xue hui, Zhongguo ke xue yuan Shenyang ying yong sheng tai yan jiu suo zhu ban, 30(11), 3991-4002.

[22] Baskaya, T. , & Aycim, F. . (2015). Disaster sensitive landscape planning for the coastal megacity of istanbul. *Journal of Coastal Conservation,* 19(5), 1-14.

[23] Corlett, & Richard, T. . (2016). *The role of rewilding in landscape design for conservation. Current Landscape Ecology Reports*, 1(3), 127-133.

[24] Sheridan, & Richard. (2016). *Ri sea grant, ri coastal resources center and uri landscape architecture department collaborate on resilient coastal*

greenways. Proceedings of the Fábos Conference on Landscape and Greenway Planning, 5(2), 14-14.

[25] Milburn, L. , & Brown, R. D. . (2016). Research productivity and utilization in landscape architecture. *Landscape and Urban Planning*, 147, 71-77.

[26] Wingren, Carola, Qvistrom, Mattias, Cerwen, & Gunnar. (2017). Evaluating soundscape intentions in landscape architecture: a study of competition entries for a new cemetery in jarva, stockholm. *Journal of Environmental Planning & Management*, 6(5),744-746.

[27] Lott, M. B. . (2015). *Collective memory as an aesthetic landscape: the costume and scenic design of william shakespeare's as you like it*. Dissertations & Theses - Gradworks..

[28] Jan, W. . (2018). Designing the garden of geddes: the master gardener and the profession of landscape architecture. *Landscape and Urban Planning,* 17(5), 198-207.

[29] Jia, L. , Ma, Q. , Du, C. , Hu, G. , & Shang, C. . (2020). Rapid urbanization in a mountainous landscape: patterns, drivers, and planning implications. *Landscape Ecology*, 35(11), 2449-2469.

[30] Qin, F., 2022. Modern Intelligent Rural Landscape Design Based on Particle Swarm Optimization. *Wireless Communications and Mobile Computing,* 2022(1), p.8246368.

[31] Li, B. and Sharma, A., 2022. Application of interactive Genetic Algorithm in landscape planning and design. *Informatica,* 46(3).