Research and Practice on Key Technology of Three-dimensional Water Network with Digital Twin in Yunnan.

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Objectives

The highest altitude in Yunnan is 6, 740 meters and the lowest is 259 meters. This huge altitude difference endows Yunnan with complex and diverse geographical environment and hydrological conditions. In order to effectively manage and optimize water resources, improve utilization efficiency and management level, digital twin platforms have become an important solution. With the birth of the metaverse technology, the model platform, as the core of the digital twin platform, has become the main skeleton neuron with more realistic virtual environments, more natural and intuitive interaction methods, and more immersive experiences, providing strong support for the development and application of the digital twin platform.

Methods

Firstly, building water resources, flood control, and other professional water conservancy models as well as remote sensing intelligent ecological control models through deep learning technology is the foundation for achieving automatic optimization of model algorithms.

Secondly, using techniques such as 3D oblique photography, 3D architectural models, oblique photography, and laser point clouds, we build models of natural backgrounds, flow field dynamics, water conservancy projects, and electromechanical equipment, and integrate the optimized models with these models to form a visual model.

Finally, the visualization engine inputs a self-optimized visualization model and enhances the visualization engine through the WebAssembly technology embedded in the WebGPU compute shader to achieve adaptation for large screens, Web terminals, and mobile devices.

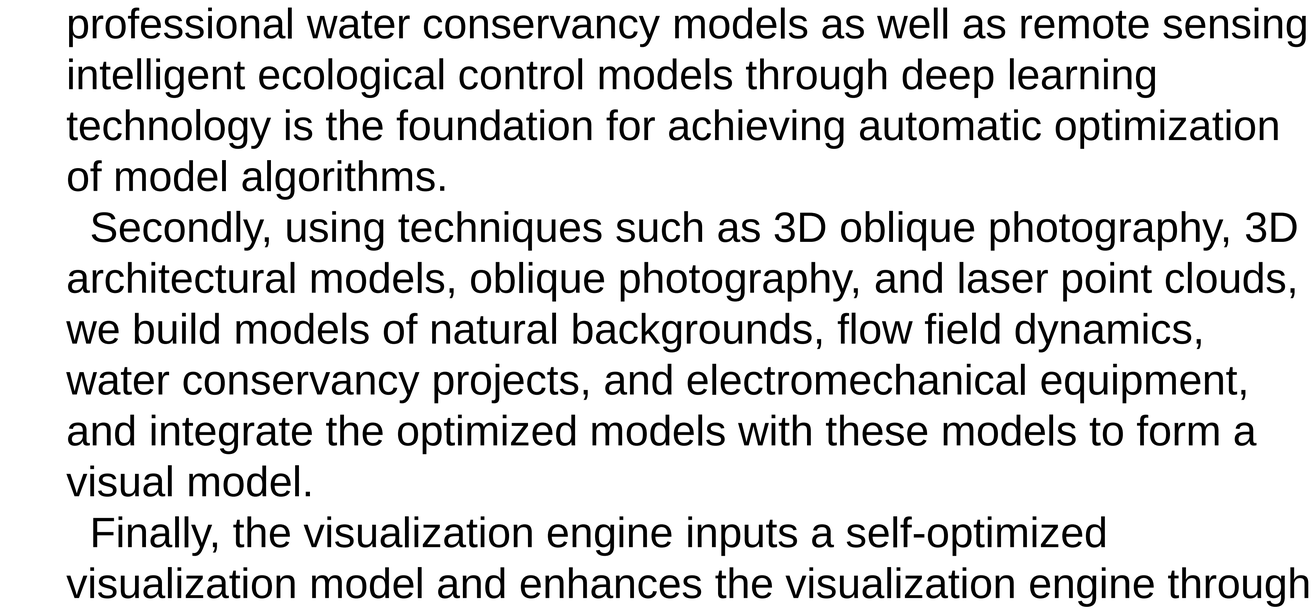

Figure1 The technical roadmap of the model platform.

Results

Water conservancy professional models can be automatically optimized with accuracy no less than 85 %, and 3D visualization rendering speed is 300 %-1500 % faster than traditional WebGL, meeting the requirements for online rendering of data exceeding GB.

Figure2 video fusion models and flooding analysis models.

Figure3 Gridded model of hydraulic project.

Conclusions

In conclusion, to construct a specialized model for water resources using deep learning technology, it is necessary to master the fundamental knowledge of deep learning, including neural networks, back-propagation algorithms, optimization algorithms, etc. Meanwhile, familiarity with water-related data and issues is required to select suitable models and optimize them.