

A Study on Neural Network Multi constraint Problems

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Abstract: This paper deals with “MULTI-CONSTRAINED PROBLEMS ON AERIAL NETWORKS” we focused on Multi-constrained problems in aerial networks demand intricate optimization approaches to ensure efficient and reliable communication in dynamic and resource constrained environments, Implications for applications across various domains, networks require simultaneous optimization of band width. , latency, reliability ,energy consumption, often with conflicting objectives , it pose significant challenges in optimizing communication networks involving airborne platforms and also involve optimizing various network Parameters while satisfying multiple constraints .

1. Introduction

The aviation industry plays a critical role in global connectivity, and the efficient management of public air route networks is of paramount importance. This study delves into the complex world of multi constrained optimization problems in the context of public air route networks. With the increasing demand for air travel and the growing complexities of airspace management, optimizing routes that consider multiple constraints is a pressing challenge.

This research explores the various constraints that impact air route planning, such as weather conditions, airspace capacity, and environmental concerns. It seeks to develop innovative optimization techniques that can address these multi constrained challenges effectively. The study employs advanced mathematical models, data analysis, and computational algorithms to provide a comprehensive analysis of the problem space(1,2).

The findings of this research are expected to have practical implications for aviation authorities, airlines, and other stakeholders. Optimizing public air route networks will not only lead to more efficient and cost-effective operations but also contribute to reduced environmental impact(3). By addressing the multi constrained optimization problems in air route planning, this study aims to enhance the sustainability and resilience of the global aviation industry(4).

A Low Altitude Public Air Route By Global Subdivision Grid

Recent studies on DGGs (Discrete Global Grid System) have proven their advantages in UAV applications. Gridding, as a promising and important technology, was incorporated into the standardization roadmap for unmanned aircraft systems by the American National Standards Institute (ANSI) Unmanned Aircraft Systems Standardization Collaborative (UASSC). Argued that the unified management of spatial information on the UAV platform can be effectively realized by adopting the spatial grid model represented by GeoSOT3D, because it will reduce the workload of flight management, airborne environmental perception, and range in the neighbourhood by the association and queries of all spatial grid data(5,6).

GeoSOT-3D theory to construct the basic spatial reference framework. The airspace is divided into regular 3D grids according to the GeoSOT-3D schema. The proposed air traffic highways are constructed by 3D grids(7). Apart from UAV-related applications, GeoSOT-3D has been extensively investigated in remote sensing data management city component identification, trajectory data storage and urban expansion monitoring(8,9).

A low-altitude public air route network for UAVs is based on corridors with different diameters and entails a minimum distance between two air routes. Although the existing method has proven its capability of ensuring the separation of UAVs and civil aviation and maintaining flight safety, its adaptability to a complex environment and efficiency in the case of a massive number of UAVs needs to be further examined. Air routes should be added or altered according to changes in the underlying surface conditions and natural conditions, however, operation in a complex environment is time-consuming, especially in emergency cases. The computations of spatial relationships between air routes and various spatial fields are complicated and involve the solution of multiple nonlinear equations.

The construction of GeoSOT-3D code is based on a binary system, which is in accordance with the storage structure of common computer systems and databases. The coding can be expressed by integers, which is suitable for all kinds of storage computing architectures and has high efficiency(10).

Previously, the spatial information of air routes and other objects was recorded by ObjecteID, but a database with GeoSOT codes as the primary key was constructed, and both the air route and the object data were recorded in a NoSQL database. We simulated the airspace environment in added several actual track data to the airspace. After completing the airspace modelling, we compared the number and data size of stored track records using longitude and latitude and different grid levels. The data size and the amount of information recorded by the subdivision grids increase with the level, as shown in Fig1.1 because a higher subdivision grid level generates a more detailed description of air routes and spatial objects and consumes more storage. If the data are not converted to grid representation, both the data size and the number of track records are larger than those after conversion. The experimental results show that the amount of data storage can be significantly reduced by subdivision. The data size using traditional expressions of latitude and longitude is approximately 15 times that using a 22-level grid, which belongs to a high grid level at different subdivision levels(11,12).

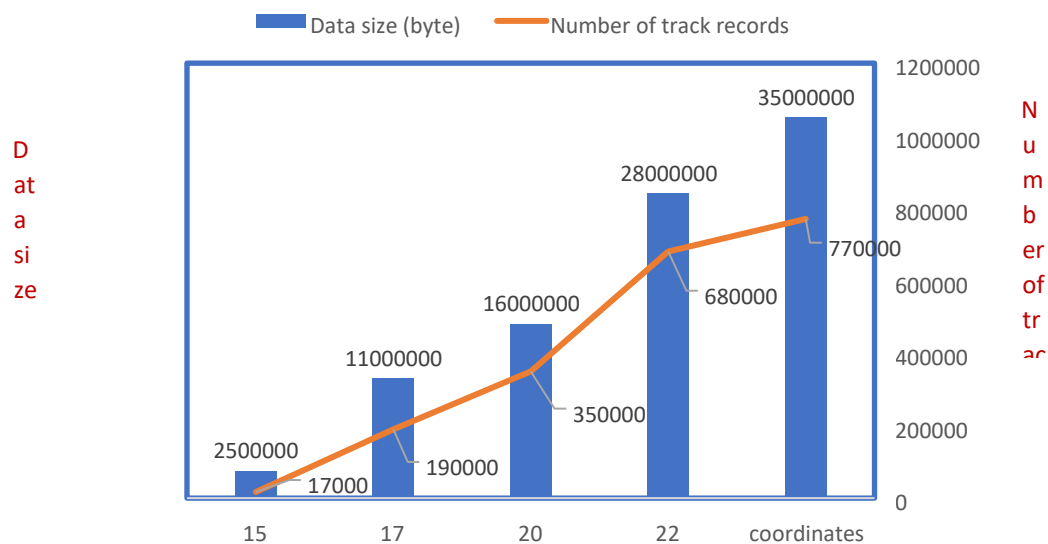


Fig 1.1 Data Size and Number of Track records

Data size refers to the storage size of the airspace, 5G and UAV information under the same airspace using different levels of GeoSOT-3D grids and coordinates methods. The number of track records indicates the number of UAV tracks stored in the airspace. We compute the time consumption for the air route trafficability, as indicated in Fig 1.2. The time consumption in the proposed methods with different levels is lower than that

of the traditional method, i.e., computation by 3D coordinates. The time consumption by coordinates is approximately 1.5 times that of the subdivision grids at level 22. In addition, the incorporation of a spatial index contributes to decreasing the time consumption. At level 22, the time consumption with the spatial index is only 1.6% of the time consumption with no spatial index.

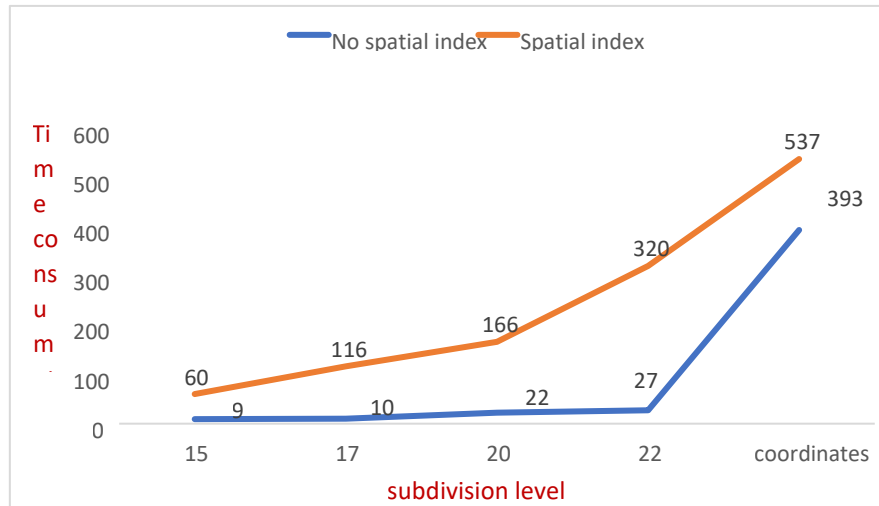


Fig 1.2 Time consumption for air route trafficability computation.

Time consumption represents the average time takes for the UAV to search its neighbourhood with or without a large database supporting index.

When a UAV is in a low-altitude airspace, it will tend to fly in an area with a stronger 5G signal, and the track should never leave the coverage area of the 5G beam. In the experiment with a 5G signal airspace field, we simulated UAV flight at GeoSOT grid levels 17, 20, and 22 and 3D coordinates. The final path planning time and optimal path storage number are shown in Fig 1.3.

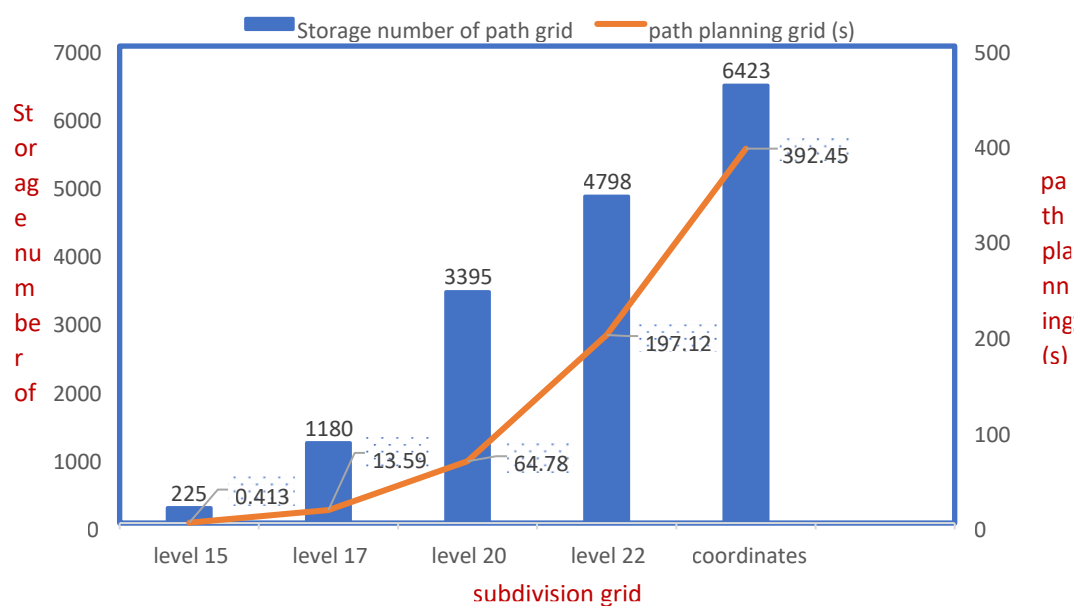


Fig 1.3 Time and storage consumption for path planning.

Storage number of the path grid refers to the number of trajectory grids generated in different environment modelling situations

In the airspace grid database, GeoSOT-3D could establish grid code databases of different levels and sizes according to actual needs to store airspace, UAV, and 5G information at the grid level that adapts to the current drone flight. In the same airspace, the storage size is half of that in the coordinate's method. In terms of the consumption time of the neighbourhood position, the GeoSOT-3D time is approximately 35% of that for the coordinates method with the database index, while the GeoSOT-3D time based on the general coordinates of the path planning time is 7 times the calculation time based on GeoSOT-3D path planning. It is easy to understand that the GeoSOT-3D spatiotemporal division grid, as a storage method of airspace expression during UAV flight, has great advantages compared with traditional longitude and latitude methods.

2. Conclusion

We have studied the basics of network theory, in Applied aircraft planning and the importance of transportation through aircrafts. The raising facts of unmanned aerial vehicles and its applications are studied. The planning methods of path and brief branches of Air controllers also have been discussed. We have worked with multi constrained problems and track records. We have also gained the information on unmanned aerial vehicle and its applications.

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