

Broadcasting of meteor appearance information using the novel application “Meteoreka”

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Introduction

Radio meteor observation is a worldwide method which using a receiver and antenna for specific radio wave frequency. The method is based on the characteristic that ionized meteor trails reflect radio waves with specific frequency. When meteors traversing the ionosphere, they create ionizing trails and that reflects radio waves to far places. However, this method requires some cost. Therefore, we made our objective, “Make everyone able to observe meteor shower easily” . We developed for realize objective by those targets: automatic meteor observation system and quickly notification of meteor appearance information. In our previous study, we have succeeded in automation from analysis and detection meteor appearance signals to broadcasting meteor appearance information. Also, we succeeded in constructing system that can collect quantitative data stably, and broadcasting the information by using chat applications. Additionally, we developed the system that analyzes meteor appearance signal by deep learning. To realize a system to solve our objective, it is required that real timed and automatic analysis of meteor appearance information. Our previous study confirmed that analyzing by deep learning has succeeded in simulation by demo data, but it had not succeeded yet in real timed data. Also, present method of broadcasting by chat applications, has some limits in the number of times of data sending. Therefore, in this study, we have developed in those system and application: 1) Real time analysis and detection system by deep learning, 2) Application “Meteoreka” that able to broadcast meteor appearance information easily and freely.

Method

Our system consists in three elements: 1) Observation part: Observe meteor radio waves and exchanges received radio wave into sound data. 2) Analysis part: Make some spectrograms from sound data and analyze it using deep learning model by python. 3) Sending part: Broadcasts meteor appearance information.

In this study, we had two experiments: Experiment I) Development and inspection of analyzing system using deep learning model by python (Analysis part): We have constructed the real timed automatic analyzing system by deep learning. Next, we have compared result of automatic analysis by the system, and result of manual analysis. Experiment II) Development of original application “Meteoreka” (Sending part): Firstly we have developed an application that can get the information of meteor appearance by accessing the database, Cloud Firestore. Also, we have developed the system that uploads meteor appearance information into our database.

Secondly, we installed it on the terminal for receiving. Next, we have inspected that can the system broadcast data correctly. Firstly, we have inputted results of analysis we got in Experiment I) into the database. Secondly, we compared sending side and receiving side (“Meteoreka”)’ s result.

Results and Discussion

In this study, we improved previous radio meteor observation system. Also we developed original application to broadcast meteor appearance information and verified its operation. First, in the Analysis part we constructed a system to automatically analyze the data in real time by deep learning and conducted a demonstration: Experiment I). We compared the result of automatic analysis and manual analysis and made sure they both matched. Next, in the Sending part, we developed a system and application called “Meteoreka” able to send meteor appearance information: Experiment II). It was enabled to upload meteor appearance information automatically and broadcast for receiving terminal. “Meteoreka” obtain and notice about whether there is meteor appearance, at certain intervals. We entered the result of analysis derived in Experiment I) automatically. Next, we confirmed that meteor appearance information matched in both sending part and receiving part. The result shows that it is confirmed that the application is working correctly. There are less limit about amount sending than conventional application.

Conclusion

We developed the system with real time analysis system using deep learning, and we also developed original application “Meteoreka” as a new means meteor appearance information system. This application could alleviate the limits significantly in the previous system, such as number of data that can be sent. However, the information can be sent by this application is limited to real time meteor appearance information only. Therefore we set our next goal is to improve the ability to acquire and view information such as meteor shower’ s maximum day, appearance direction, and more about past meteor observation and meteor shower.

Keywords: Radio meteor observation, Python, Deep learning, Application development