On Trajectory Interpolation using LSTM

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Abstract

There are various problems in interpolate the GPS trajectory when GPS data is not collected at regular intervals, it should be treated as continurous data. In this paper we propose a model using LSTM, for interpolation, and report the evaluation results of interpolation with continuous values of both coordinates and time.

Keywords: Trajectory, Machine learning, Modeling, prediction, time series analysis

1. Introduction

GPS data is very useful for understanding the living things. For example, in ethology, there is researches using GPS attached to animals to estimate not only the movement route and habitat but also secondary information such as foraging and rest and the cause of behavior. In recent years, GPS data accumulation has been further progressed with the spread of mobile and wearable devices. A more advanced method for analyzing GPS series data is required. However collected GPS data is often deficient, including in minutes or even days.

2. Problem and method

Since GPS time series data may not be collected at regular intervals, it is difficult to handle such defects. Many of the interpolation methods are simple, such as linear interpolation. Therefore, the behavioral characteristics of living things cannot be maintained. Various models have been devised to estimate routes based on state transitions and stochastic processes. However these method only estimate the "next" position of a place and do not take into account information about "time". Therefore, We propose a model that estimates the missing GPS data using continuous values with time by using LSTM, a machine learning method suitable for time series data LSTM is a recurrent neural network that introduces three gates: input, output, and forgetting gates for learning long-term relationships of data. We assume that an LSTM model can create a feature expression that can be used for
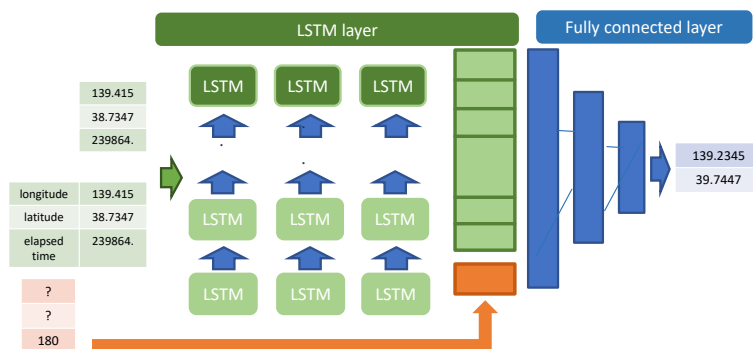
Figure 1: Model based LSTM.

interpolation, In this paper, we propose a model that handles seabird behavior trajectories with missing parts, extracts trajectory feature expression using LSTM, and interpolates the GPS deficit with continuous time (Figure1).
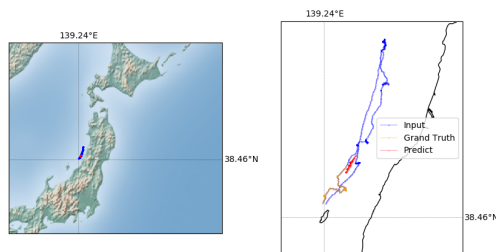

Figure 2: Interpolation Result.

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References

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