Time-Series

A biased review and directions

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Contents

1 Overview

Abstractly, time-series is the progression of some process over time. We might say that time-series is a special case of a sequence that is dependent on time, that is, there is something more special about time as another dimension. In this perspective, we see that time should be considered as the central variable when deconstructing a series of data. This then allows us to create systems that are intrinsicly online and more representative of physical reality.

1.1 Applications

The applications of time-series analysis are far reaching but historically the notion has been considered in tasks such as prediction and classification. For example, weather forecasting, stock markets, and human vital signs can be considered good examples of time-series data. This may be primarily because the patterns in these signals can be explained as direct result of other observable phenomena, or that the series of data arrives due to a complex interaction of more simple processes. Given that we can formulate these simple processes, the task is then to model their interaction between each other over time.

Other areas such as audio and vision can fall under the definition of time-series, but their inherent difficulty as tasks themselves mean that approaching them from this perspective is not reasonable; the depth of understanding required for even one time-step diverts all focus to the study of the sense itself. Without strong assumptions of the sense the task is left with exponentially many paths of computation which is infeasible with current technology. An interesting path of research is then to consider some of these senses as more of a time-series problem, using expert knowledge where appropriate. Combined with some useful level of interpretability, we can evaluate how a model learns and reacts to new forms of data in relation to previous data it has encountered. These aspects would then reveal some insight into what constitutes an intelligent deducing system.