

# Comparing Time-Series Clustering Algorithms in R Using the `dtwclust` Package

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## Abstract

Most clustering strategies have not changed considerably since their initial definition. The common improvements are either related to the distance measure used to assess dissimilarity, or the function used to calculate prototypes. Time-series clustering is no exception, with the Dynamic Time Warping distance being particularly popular in that context. This distance is computationally expensive, so many related optimizations have been developed over the years. Since no single clustering algorithm can be said to perform best on all datasets, different strategies must be tested and compared, so a common infrastructure can be advantageous. In this manuscript, a general overview of shape-based time-series clustering is given, including many specifics related to Dynamic Time Warping and other recently proposed techniques. At the same time, a description of the `dtwclust` package for the R statistical software is provided, showcasing how it can be used to evaluate many different time-series clustering procedures.

*Keywords:* time-series, clustering, R, dynamic time warping, lower bound, cluster validity.

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## 1. Introduction

Cluster analysis is a task which concerns itself with the creation of groups of objects, where each group is called a cluster. Ideally, all members of the same cluster are similar to each other, but are as dissimilar as possible from objects in a different cluster. There is no single definition of a cluster, and the characteristics of the objects to be clustered vary. Thus, there are several algorithms to perform clustering. Each one defines specific ways of defining what a cluster is, how to measure similarities, how to find groups efficiently, etc. Additionally, each application might have different goals, so a certain clustering algorithm may be preferred depending on the type of clusters sought (Kaufman and Rousseeuw 1990).

Clustering algorithms can be organized differently depending on how they handle the data and how the groups are created. When it comes to static data, i.e., if the values do not change with time, clustering methods can be divided into five major categories: partitioning (or partitional), hierarchical, density-based, grid-based and model-based methods (Liao 2005; Rani and Sikka 2012). They may be used as the main algorithm, as an intermediate step, or as a preprocessing step (Aghabozorgi *et al.* 2015).

Time-series is a common type of dynamic data that naturally arises in many different scenarios, such as stock data, medical data, and machine monitoring, just to name a few (Aghabo-

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This manuscript was last updated in version 5.5.0 of `dtwclust`. A summarized version was published in Sardá-Espinosa (2019).

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## **Comparing Time Series Clustering Algorithms In R Using The:**

**Information Technologies and Intelligent Decision Making Systems** Arthur Gibadullin, 2024-04-30 This book constitutes the refereed post proceedings of the Third International Scientific and Practical Conference on Information Technologies and Intelligent Decision Making Systems ITIDMS 2023 held in Moscow Russia during December 12 14 2023 The 18 full papers included in this book were carefully reviewed and selected from 54 submissions The papers presented in this volume focus on topics such as digital intellectual and information transformation the development of computer models and the improvement of automated and computing processes

**Advanced Data Mining and Applications** Guojun Gan, Bohan Li, Xue Li, Shuliang Wang, 2018-12-28 This book constitutes the refereed proceedings of the 14th International Conference on Advanced Data Mining and Applications ADMA 2018 held in Nanjing China in November 2018 The 23 full and 22 short papers presented in this volume were carefully reviewed and selected from 104 submissions The papers were organized in topical sections named Data Mining Foundations Big Data Text and Multimedia Mining Miscellaneous Topics

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*Sensing Technology* Nagender Kumar Suryadevara, Bobby George, Krishanthi P. Jayasundera, Subhas Chandra Mukhopadhyay, 2023-04-08 This book gathers the latest advances innovations and applications in the field of sensing technology as presented by international researchers and engineers at the 15th International Conference on Sensing Technology ICST held in Sydney Australia on December 5 7 2022 Contributions include a wide range of topics such as vision sensing sensor signal processing sensors phenomena and modelling sensor characterization smart sensors and sensor fusion electromagnetic chemical and physical sensors electronic nose technology biosensors nano sensors wireless sensors and WSN Internet of Things optical sensors sensor arrays intelligent sensing Internet based and remote data acquisition The contributions which were selected by means of a rigorous international peer review process present a wealth of exciting ideas that will open novel research directions and foster multidisciplinary collaboration among different specialists

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Rainer Röhrig,Antje Timmer,Harald Binder,Ulrich Sax,2017-09-15 We live in an age characterized by computerized information but ubiquitous information technology has profoundly changed our healthcare systems and if not adequately trained to deal with it healthcare professionals can all too easily be overwhelmed by the complexity and magnitude of the data This demands new skills from physicians as well as novel ways to provide medical knowledge Selecting and assessing relevant information presents a challenge which can only be met by bridging the various disciplines in healthcare and the data sciences This book presents the proceedings of the 62nd annual meeting of the German Association of Medical Informatics Biometry and Epidemiology German Medical Data Sciences GMDS 2017 Visions and Bridges held in Oldenburg Germany in September 2017 The 242 submissions to the conference included 77 full papers of which 42 were accepted for publication here after rigorous review These are divided into 7 sections teaching and training epidemiological surveillance screening and registration research methods IT infrastructure for biomedical research data integration centers healthcare information systems interoperability standards terminologies classification and biomedical informatics innovative algorithms and signal processing The book provides a vision for healthcare in the information age and will be of interest to all those concerned with improving clinical decision making and the effectiveness and efficiency of health systems using data methods and technology

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Massih-Reza Amini,Stéphane Canu,Asja Fischer,Tias Guns,Petra Kralj Novak,Grigorios Tsoumakas,2023-03-17 The multi volume set LNAI 13713 until 13718 constitutes the refereed proceedings of the European Conference on Machine Learning and Knowledge Discovery in Databases ECML PKDD 2022 which took place in Grenoble France in September 2022 The 236 full papers presented in these proceedings were carefully reviewed and selected from a total of 1060 submissions In addition the proceedings include 17 Demo Track contributions The volumes are organized in topical sections as follows Part I Clustering and dimensionality reduction anomaly detection interpretability and explainability ranking and recommender systems

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In some sort of driven by information and connectivity, the energy of words has are more evident than ever. They have the capability to inspire, provoke, and ignite change. Such could be the essence of the book **Comparing Time Series Clustering Algorithms In R Using The**, a literary masterpiece that delves deep in to the significance of words and their impact on our lives. Compiled by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we shall explore the book is key themes, examine its writing style, and analyze its overall effect on readers.

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