

Study on Statistical Convergence and its Application

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Abstract

Statistical convergence is an important concept in modern analysis that extends the classical notion of convergence of sequences. It provides a useful framework for studying sequences whose convergence may fail in the ordinary sense but whose exceptional terms form a set of asymptotically negligible density. This paper presents a systematic study of statistical convergence and its relationship with ordinary convergence. The fundamental definitions and properties of statistically convergent sequences are discussed, along with concepts such as statistical limit, statistical Cauchy sequences, and density-based convergence. The study examines important results concerning the uniqueness of statistical limits, subsequence's, boundedness, and the relationship between ordinary and statistical convergence. Particular attention is given to the role of natural density in identifying the behaviour of sequences and determining their statistical limits. The paper further explores applications of statistical convergence in approximation theory, sum ability theory, sequence spaces, numerical analysis, and optimization. Statistical convergence can be particularly useful in situations where occasional deviations or irregular terms do not significantly affect the overall limiting behaviour of a sequence. The study demonstrates that this generalized form of convergence provides a flexible mathematical tool for analysing sequences arising in theoretical and applied contexts. The paper also indicates the potential for extending statistical convergence through ideal convergence, lacunary statistical convergence, and related generalized convergence methods. These developments broaden the scope of convergence theory and provide useful mathematical frameworks for contemporary analytical problems.

Keywords: Statistical Convergence, Natural Density, Statistical Limit, Statistical Cauchy Sequence, Sequence Spaces, Sum ability Theory, Approximation Theory, Convergence