$\mathcal{I}_2$-$\overline{\lambda}$-statistically convergence of double sequences in fuzzy normed spaces

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Abstract. In this paper, we have investigated $\mathcal{I}_2$-$\overline{\lambda}$-statistically convergence for double sequences in fuzzy normed linear spaces, where $\lambda = (\lambda_r)$ and $\mu = (\mu_s)$ be two non-decreasing sequences of positive real numbers, each tending to ∞ and such that $\lambda_{r+1} \leq \lambda_r + 1$, $\lambda_1 = 1$; $\mu_{s+1} \leq \mu_s + 1$, $\mu_1 = 1$. Some inclusion relations between $\mathcal{I}_2$-statistically convergent and $\mathcal{I}_2$-$\overline{\lambda}$-statistically convergent double sequences in fuzzy normed linear spaces are established. Finally, we have introduced $\mathcal{I}_2$-$\left[V, \overline{\lambda}\right]_{FN}$-summability and $\mathcal{I}_2$-$[C, 1]_{FN}$-summability of double sequences, and then, we have studied the relation between these concepts and $\overline{\lambda}$-statistical convergence.

Keywords: Statistical convergence, $\mathcal{I}$-convergence, λ-convergence, fuzzy norm, double sequences

1. Introduction

The notion of statistical convergence of sequences of numbers was introduced by Fast [12] and Schoenberg [57] independently. Later on, statistical convergence turned out to be one of the most active areas of research in summability theory after the works of Fridy [13] and Šalát [14]. Connor [8] have studied the concept statistical convergence in summability theory. Mursaleen and Edely [23] extended the above idea from single to double sequences of scalars and established relations between statistical convergence and strongly Cesàro summable double sequences. Tripathy [38] studied on statistical convergence of double sequences. A lot of useful developments of double sequences in summability methods can be found in Çakan and Altay [4], Altay and Başar [5].

The idea of λ-statistical convergence was introduced and studied by Mursaleen [24] as an extension of the $[V, \lambda]$ summability of Leindler [25]. Many mathematicians such as Çolak [6], Et and Cinar [7] have studied on λ-statistical convergence.

The concept of ideal convergence plays a vital role not only in pure mathematics but also in other branches of science involving mathematics, especially in information theory, computer science, biological science, dynamical systems, geographic information systems, population modeling and motion planning in robotics.

Among various developments of the theory of fuzzy sets [42] a progressive development has been made to find the fuzzy analogues of the classical set theory.

In fact the fuzzy set theory has become an area of active research for the last 40 years. The notion of fuzzyness are using by many persons for Cybernetics, Artificial Intelligence, Expert System and Fuzzy control, Pattern recognition, Operation research, Decision making, Image analysis, Projectiles, Probability theory, Agriculture, Weather forecasting.

The fuzzy set theory has been used widely in many engineering applications, such as, in bifurcation of non-linear dynamical systems, in the control of chaos, in the non-linear operator, in population dynamics.

In many situations, we can't determine the norm of a vector exactly and hence it seems that the concept of a fuzzy norm is more suitable than a crisp norm in these cases, namely, we can model the inexactness by fuzzy norm.

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