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Linear and nonlinear stochastic distribution for consensus problem in multi-agent systems (Article)

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Abstract

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This paper presents a linear and nonlinear stochastic distribution for the interactions in multi-agent systems (MAS). The interactions are considered for the agents to reach a consensus using hetero-homogeneous transition stochastic matrices. The states of the agents are presented as variables sharing information in the MAS dynamically. The paper studies the interaction among agents for the attainment of consensus by limit behavior from their initial states' trajectories. The paper provides a linear distribution of DeGroot model compared with a nonlinear distribution of change stochastic quadratic operators (CSQOs), doubly stochastic quadratic operators (DSQOs) and extreme doubly stochastic quadratic operators (EDSQOs) for a consensus problem in MAS. The comparison study is considered for stochastic matrix (SM) and doubly stochastic matrix (DSM) cases of the hetero-homogeneous transition stochastic matrices. In the case of SM, the work's results show that the DeGroot linear model converges to the same unknown limit while CSQOs, DSQOs and EDSQOs converge to the center. However, the results show that the linear of DeGroot and nonlinear distributions of CSQOs, DSQOs and EDSQOs converge to the center with DSM. Additionally, the case of DSM is observed to converge faster compared to that of SM in the case of nonlinear distribution of CSQOs, DSQOs and EDSQOs. In general, the novelty of this study is in showing that the nonlinear stochastic distribution reaches a consensus faster than all cases. In fact, the EDSQO is a very simple system compared to other nonlinear distributions. © 2018, The Natural Computing Applications Forum.

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Author keywords

Consensus problem | Linear stochastic distribution | Multi-agent systems | Nonlinear stochastic distribution

Indexed keywords

Engineering controlled terms: Matrix algebra | Stochastic models | Stochastic systems

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