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ABSTRACT: Mathematical modeling is an important approach to research rumor propagation in online social networks. Most of prior work about rumor propagation either carried out empirical studies or focus on ordinary differential equation models with only consideration of temporal dimension; little attempt has been given on understanding rumor propagation over both temporal and spatial dimensions. This paper primarily addresses an issue related to how to define a spatial distance in online social networks by clustering and then proposes a partial differential equation model with a time delay to describing rumor propagation over both temporal and spatial dimensions. Theoretical analysis reveals the existence of equilibrium points, *a priori* bound of the solution, the local stability and the global stability of equilibrium points of our rumor propagation model. Finally, numerical simulations have analyzed the possible influence factors on rumor propagation and proved the validity of the theoretical analysis.

Keywords: rumor, propagation, social networks, partial differential equation, stability