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Abstract:
The evolution of population color categorization systems is investigated using game theory simulation techniques. Categorization systems are based on human empirical data in the form of Farnsworth-Munsell 100 Hue Test results to, in part, model artificial agents with some realistic constraints from human populations. Constraints include (i) varying amounts of normal observer heterogeneity, and (ii) varying degrees and forms of observer color deficiency, and are made operational in agent categorization and communication games. They produce a number of interesting consequences for stable, shared categorization solutions that are evolved in agent populations. It is found that the confusion patterns associated with a small fraction of color deficient agents break symmetries in population categorization solutions, and confine the boundaries of color categories to a small subset of available locations. Further, confusion pattern variations across different types of deficient agents lead to changes in category size and number that depend on the form of deficiency represented. In particular, stimulus pairs forming global confusion axes for dichromats tend to attract color boundaries, and local confusion regions characteristic of both dichromats and anomalous trichromats tend to repel color boundaries. Furthermore, the concurrent presence of normal agents and several different kinds of deficient agents produces novel constrained solutions that optimize successful categorization performance in population communication games involving color.