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Coordenadores

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Diretor do Instituto de Física de São Carlos – Universidade de São Paulo

Prof. Dr. Javier Alcides Ellena

Presidente da Comissão de Pós Graduação do Instituto de Física de São Carlos – Universidade de São Paulo

Profa. Dra. Tereza Cristina da Rocha Mendes

Presidente da Comissão de Graduação do Instituto de Física de São Carlos – Universidade de São Paulo

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Gabriel dos Santos Araujo Pinto

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Jeffer Santiago Mares

João Victor Pimenta

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Normalização e revisão – SBI/IFSC

Ana Mara Marques da Cunha Prado

Maria Cristina Cavarette Dziabas

Maria Neusa de Aguiar Azevedo

Sabrina di Salvo Mastrantonio

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Classifying phenotypes using information theory

MARTINELLI, Tiago; LÁZARO, Carlos Gracia; RODRIGUES, Francisco Aparecido; MORENO, Yamir

tiago.martinelli@usp.br

Social collective phenomena involving strategic interactions are widespread in the real world often in systems having multiple types of individuals, each one with its behavior and decision-making. Typical analyses of these types of systems aim to establish general behavioral rules dictating individuals' actions. Applying an unsupervised clustering algorithm, Poncela-Casasnovas *et al.* (1) defined a comprehensive classification of the underlined strategies to a limited number of behavioral phenotypes for a lab-in-the-field experiment in which subjects face four different dyadic games, intending to establish general behavioral rules dictating individuals' actions. Here, we revisited such classification from an informational theoretical point of view. We constructed a black-box model where, given a specific round, the dyadic game and player's strategies were the input variables, and the respective payoff was the output. Such construction can be seen as an information-processing channel. Using Shannon's theory and the partial information decomposition (PID) (2-3) we computed for each phenotype's channel the mutual information followed by its decomposition into redundant, unique, and synergistic information atoms. We found empirical informational constraints classifying each phenotype. We discuss the possible interpretation of these inequalities by linking the agent's levels of rationality according to the percentage of redundant, synergistic, and unique information. This work also opens the door for a new approach to classification problems using tools from Partial Information Theory.

Palavras-chave: Game theory. Information theory. Classification problems.

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