Game theoretic machine learning methods can help explain long periods of conflict

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Researchers at the Santa Fe Institute have developed new machine learning methods to study conflict. Their work appears in *PLOS Computational Biology* on May 13.

Quantitative studies of behavior traditionally rely on game theory to investigate the logic of conflict. Game theory seeks to identify normative strategies that maximize payoffs for individuals in the face of uncertainty.

Although game theory has been very useful for determining which of a predefined set of strategies - for example, "tit for tat" - will be stable given certain assumptions, its has not proven to be very useful for determining what the natural strategy set is, or which strategies individuals are using out of equilibrium. Game theoretic models are also not practical for studying strategies when interactions involve multiple players interacting simultaneously. This is the case in many complex animal and human systems.

Santa Fe Institute Omidyar Postdoctoral Fellow Simon DeDeo and Institute faculty members Jessica Flack and David Krakauer developed the new method, which they call Inductive Game Theory, and applied it to a time series of fights gathered from detailed observations of an animal society model system.

"With these approaches, we can identify those strategies likely to generate periods of intense conflict," DeDeo says.

"Fights are not explained by 'rogue actors,' or single aggressive individuals, but by complex interactions among groups of three or higher, and the decision to fight is very much dependent on memory for what happened in previous conflicts," says Krakauer.

"These results suggest that individual agency has been over-emphasized in social evolution," says Flack. "We need to re-examine the idea that a single individual or nation can cause turbulent periods in history and consider the possibility that what predicts long periods of conflict is how we respond to the actions of our friends and enemies in their conflicts."

"This new empirically-grounded approach to conflict is a crucial step towards designing better methods for prediction, management and control," she says.

Provided by Santa Fe Institute

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