

## Discovering Strategic Behavior for Collaborative Content-Production in Social Networks

Professor gives a brief introduction before the presentation. He says that sometimes people are strategic in their interactions and he gives an example that Alice said something because she really wanted other thing to happen. Therefore, people being strategically are not really surprising. He points out that from empirical data, there is little work to suggest that people can learn strategies over time. He also mentions that this paper does not talk about rationality and strictly rational is impossible because all of us are resource-limited.

When Yash is giving the example of Instagram stories, professor asks a broad question: "How do we discover payoffs?". For example in this paper, they ask how do a researcher decide where to publish, should they publish at a high prestige conference so they can get their works out or publish at a low prestige conference with high acceptance rate? Learning strategic behavior applies in a lot of different context. Another example is all of us make a decision to take this class (CS598HS), and how do we figure out our own decisions based upon the outcomes after this class? Will we think about long-term payoffs or short-term payoffs? The point is that the payoffs of decisions that we make over time are unknown and it is very hard for us to evaluate those decisions. However, there are scenarios that the behaviors are repeated where some people start to pay attentions between what they did with the payoffs they can observe for their behaviors.

After Yash talks about the strategies of the influencers, professor ask how did those influencers figure these strategies out? Did they do experiments that they try something and figure out the payoff? Besides, something the payoffs are difficult to determine. They would not see their ad revenues for a few month. Yash answers that it is a hard question and he thinks they just do trial-and-error and figure out what they can get the maximum number of viewers. He also mentions that the payoffs for those influencers should be the number of views or the money they gain? He thinks it is more about the money they gain. Some students in the chat room say they can copy strategies from others, but the professor mentions one crucial point which is they can only see what they do but not why they do it.

One of the students asked for clarification about what familiarity means in the context of strategy spaces. Tai-Ying explains that familiarity strategy refers to the idea that papers may preferentially cite other papers based on authorship; for example, self-citation is a well-known strategy to boost the popular h-index. In addition, the professor says that the set of papers published before time  $t$  are partitioned into two disjoint sets:

set A: papers, each of which has one of the co-authors of original content as a co-author.

set B: complementary set

When explaining the training and optimization process of the model, we explains that basically the author tries to maximize the likelihood of the observed edge conditioned on the strategy distribution, and this equivalent to minimize the negative log likelihood. One student

asks does this means they train their model based on maximum likelihood estimation (MLE), and Tai-Ying replies yes, what they try to maximize the likelihood that observed from the dataset.

In this domain of strategies, all one is doing is changing the posterior distribution of the paper over the set of papers one is picking, and one is not determining as to which paper to cite. The professor explains further that in classic game theory when one picks the strategy/row in the payoff matrix, it indicates the exact action one will take, but, here, it means that one changes the distribution of the actions from which one has to pick the action. Why so? The strategies are not over the actions themselves, but it's over the distributions from which one picks the action, because actions are visible and observable, unlike the strategies. The professor strengthens his point by giving an example that he can view the paper that author X has cited, but the underlying strategies that led author X to choose that paper are not visible to him. Additionally, X could have adopted a completely different strategy than the professor and still cited the same paper.

Professor adds the interesting insights related to the paper and discusses following four questions.

*Q1. If two authors were in top 10%, that is those who have stable preference, what is the probability that they have co-authored in the past?*

The results are pretty striking. If one is in 1%, then it is highly likely that you collaborate with other authors in 1% (that is with a probability of 12.20%). Co-authorship is not random. It is fascinating to see that the behaviour of top 10% authors are very different from the bottom 90% authors. People who are in more successful tend to collaborate with other successful people. In conclusion, authors are being strategic while picking co-authors and if the otherwise was true, all the values would be 25%, which is not the case.

*Q2. Let's say co-author X has a stable Preference Distribution, that is strategy is stable at time t, while co-author Y's profile is not stable at time t, then how is Y's strategy distribution influenced by X's stable strategy?*

The answer is not deterministic and is subject to future work.

*Q3. How are the norms learnt? Say, norms are learnt if the authors are in same institution. Following up on the argument, given the two authors belong to the top 10% category, then what is the probability that those two authors belong to the same institution?*

It's challenging to find it because DPLB dataset doesn't have consistent value. The parsing of location value is tricky. For instance, MIT can be represented both by its abbreviation and full form.

*Q4. What will happen if co-authorship is added to the strategy space?*

The idea that one picks co-authors selectively while working on a project hasn't been factored into the strategy space described in the paper. This should have been taken into consideration, since there is a strategy involved in choosing a co-author as depicted by the

findings of the first question. Thus, not including it in the strategy space is one of the flaws of the paper. The professor follows up with a question to the class that why is this not included in the strategy space? This is because strategy spaces of papers and authors are being shared, so the information can easily propagate from users to authors and the other way around. If one changes the strategy space, then the neural architecture has to be also modified.

The professor remarks a strong point that discovering a good strategy space is a hard problem. So another limitation of the paper is that if one changes the strategy space, then how stable are the results of the paper? The professor mentions that additional experiments will be done regarding that in the future.