Kent State Computer Science/Physics Update

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What is *stochastic diffusion model*

A ***stochastic diffusion model*** for a social graph G=(V,E) specifies the randomized progress of generating **active** sets S_t for all t>=1 given the initial seed set S_0.

If all t ≧ 1, $S_{t-1} \subseteq S_t$, nodes only go from inactive to active,

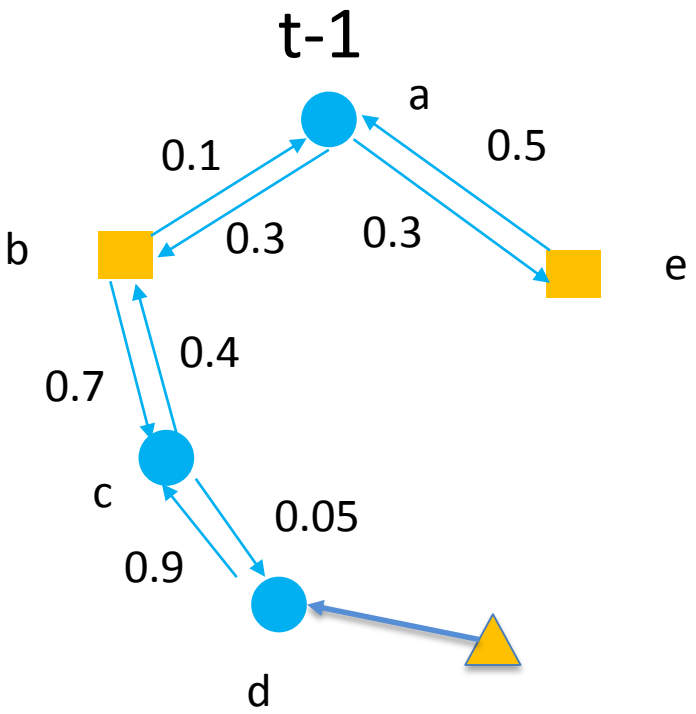
we call it **progressive process.**

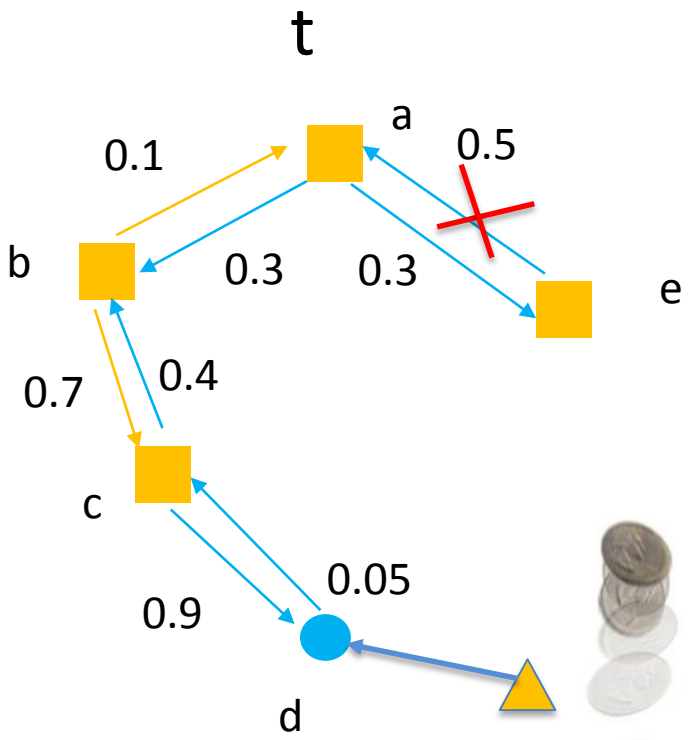
What is influence spread？ Definition

$\Phi(S_0)$ is the *final stable activated* set of nodes in stochastic process of diffusion model, with seed set S_0

$\sigma = E(\ |\Phi(S_0)\ |)$ is the expectation of this set(amount of nodes), called influence spread

Example——Independent Cascade Model





Just activated sets={ }

Inactive sets={ }

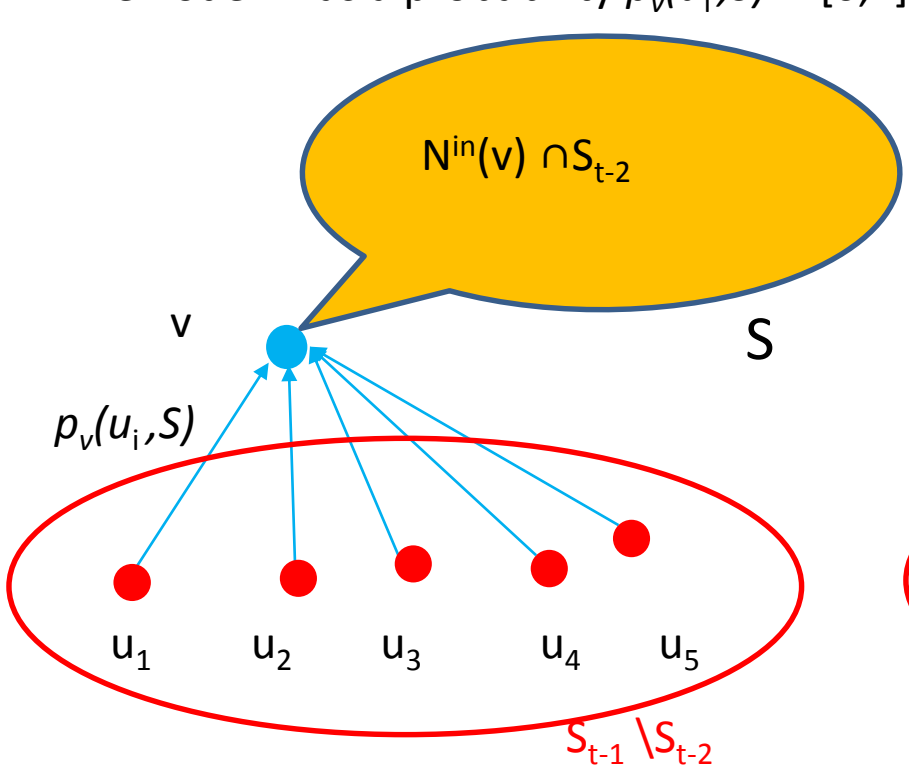
Old activated sets={ }

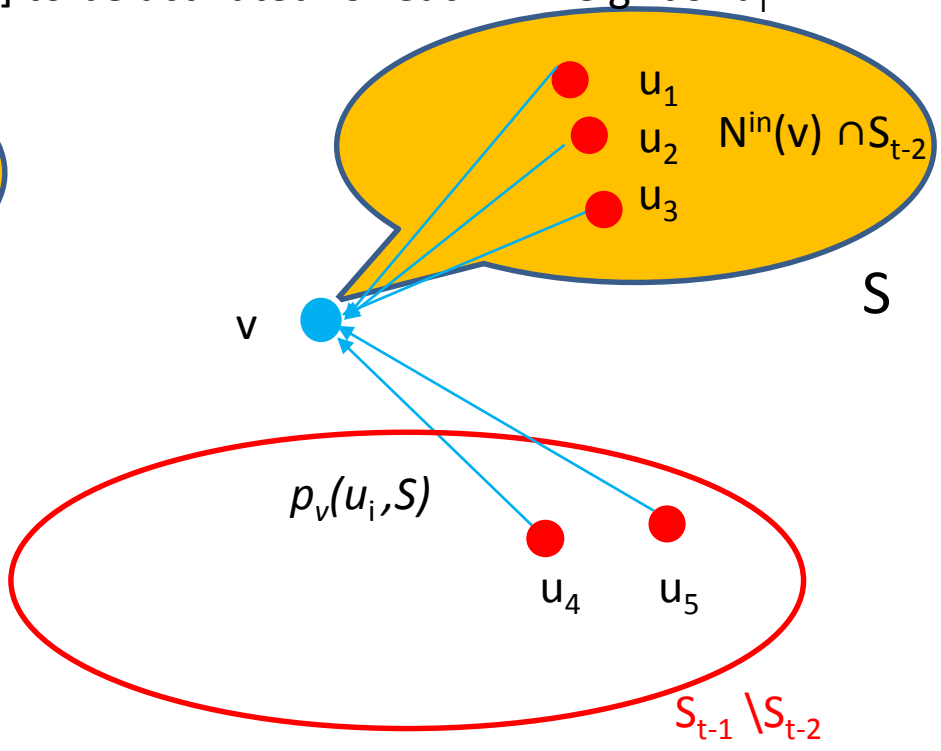
General Cascade Model the model makes more sense :

If inactive node v at ***time t-1*** has *just activated* in-neighbors sets $\{u\}= N^{in}(v) \cap (S_{t-1} \setminus S_{t-2})$, nodes in {u} will activate v one by one

If part of the nodes set u ,$\{u_1,u_2....u_{i-1}\}$ failed to activate v. They will form a set $S=(N^{in}(v) \cap S_{t-2}) \cup \{u_1,u_2....u_{i-1}\}$

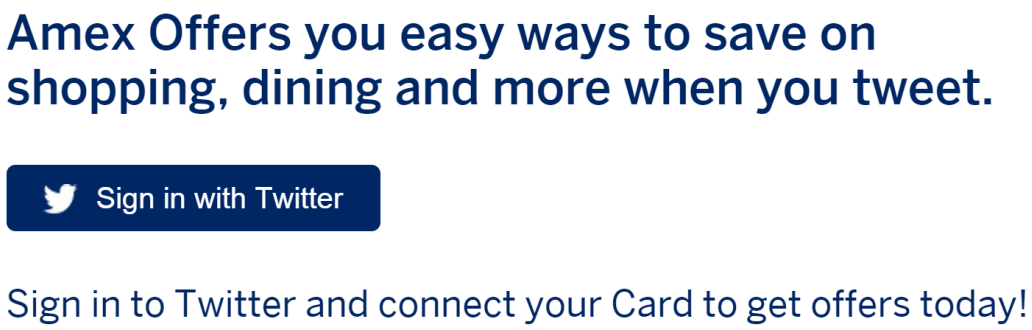
The node v has a probability $p_v(u_i,S) \in [0,1]$ to be activated for each in-neighbor u_i





Propagation of American Express Promotions

The American Express allow their card members sync their twitter accounts with their American Express credit card.

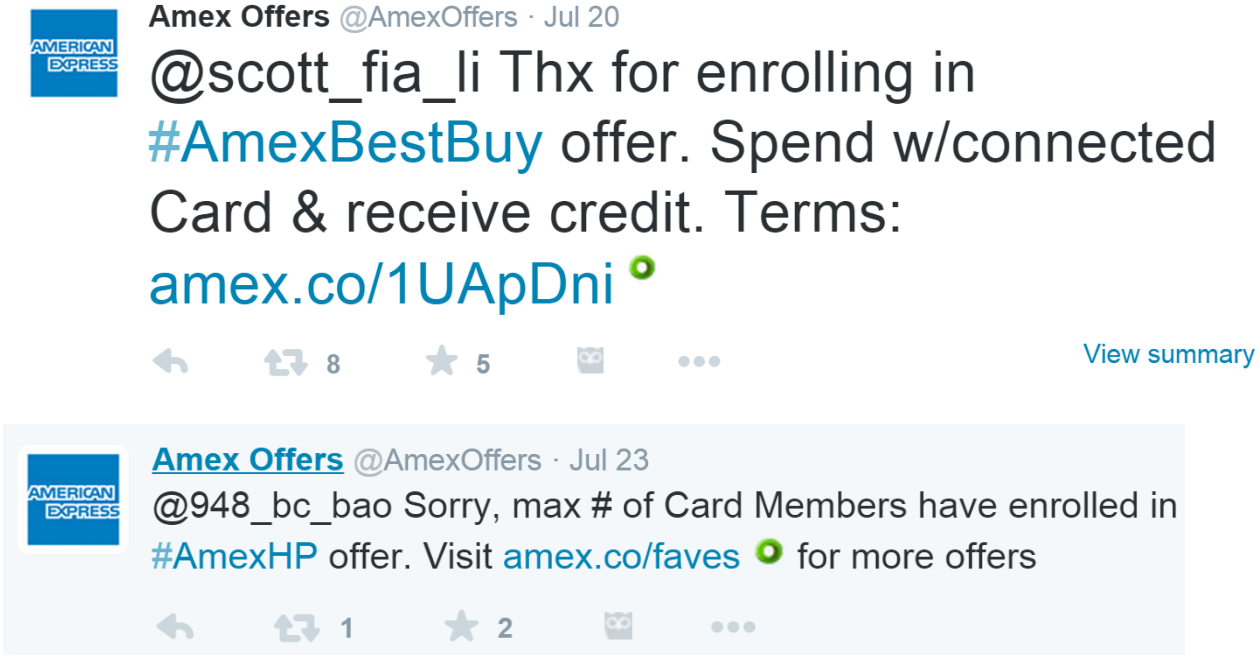


Once the twitter account @Americanexpress posted a hashtag such as #AmexStaples, then those cardmenbers can tweet the exactly same hash tag to get the promotions when they shopped with their Amex-express card.

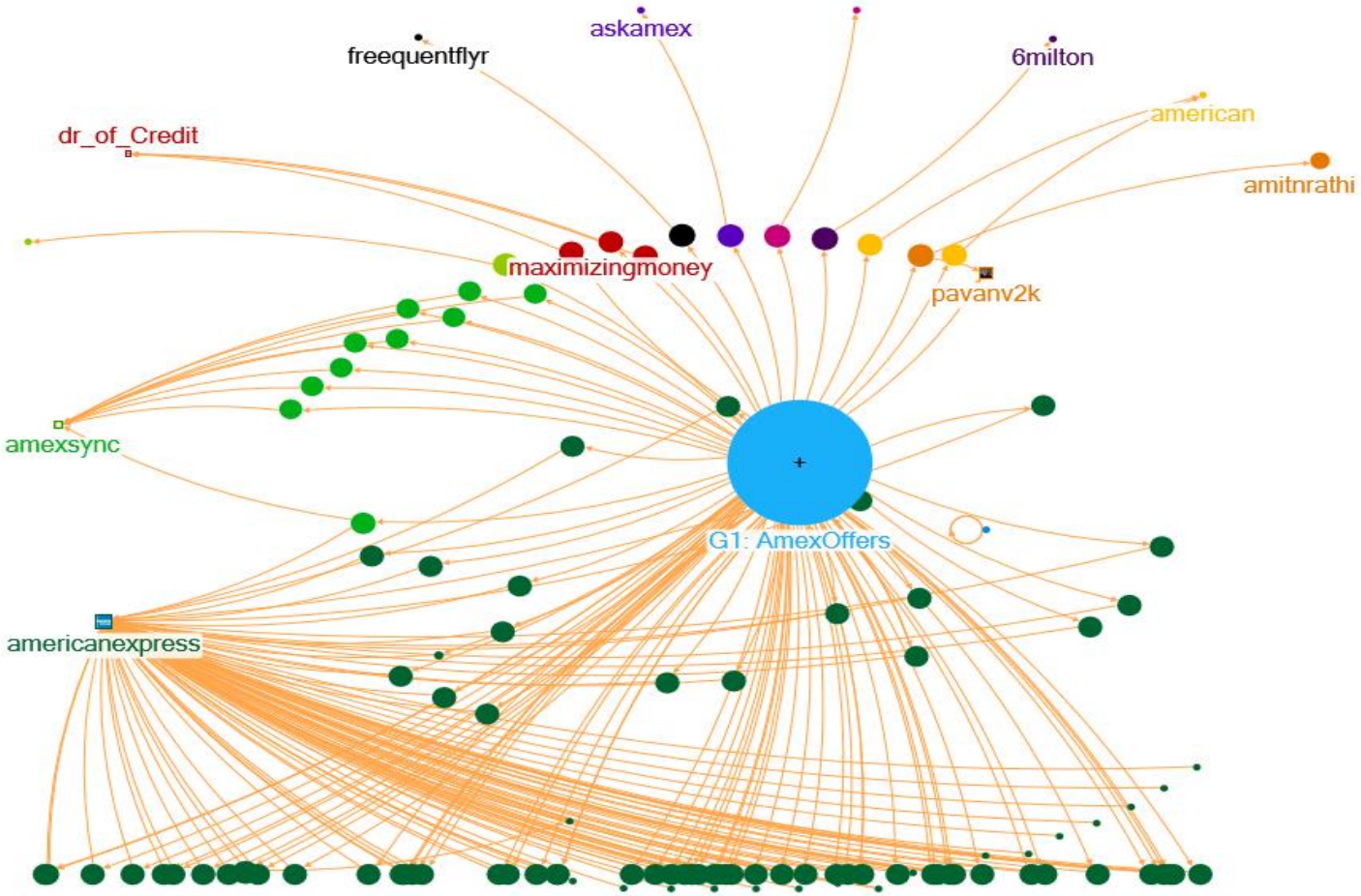
The @AmericanExpress posts promotions

User @3.141592653…. got the promotion as his retweet contains the hash tag #AmexOrvis

- Once a user was confirmed to got the promotion, another account , @AmexOffers will mention the card member in a tweet. If it failed, it will tell the reason.



Visualization about the process of promotion



Why this model

- The promotions appears randomly and face to all the card holders. So every card member have a potential to make one or two purchase. This could be interpreted as they have some probability to be activated.

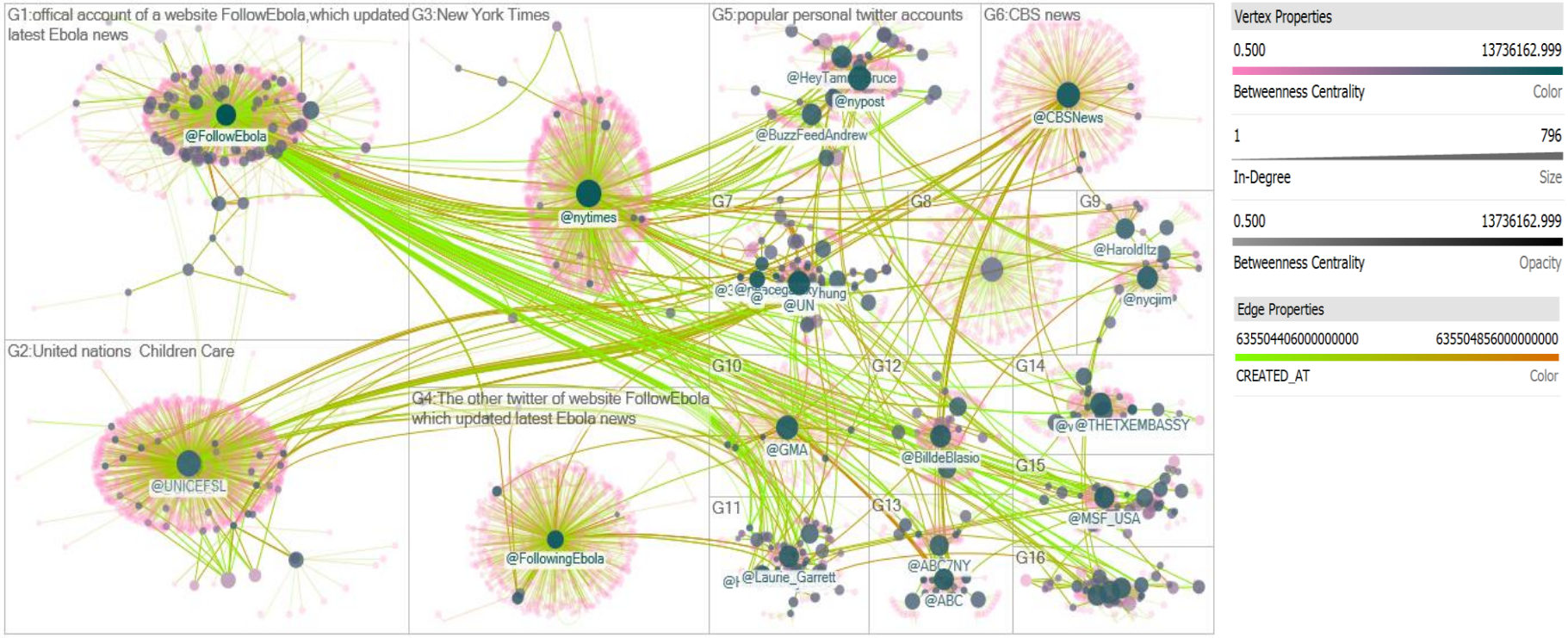
- Once a credit card member add the promotion, he doesn't have to cancel that promotion. This event satisfies the definition of progressive process.

To do list

- Build more sophisticate math models to describe the promotion activity online , not just the American Express promotion. And prove its correctness.
- Develop a good algorithm to maximize the influence spread, which means to find a better way of advertisement.
- Define the entropy in the propagation process.
- Incorporate the development into the open source tool in Kent State.

Thank you for your attention!
Comments/suggestions are welcome!

Begins with the spread of Ebola news on twitter



Data is provided by HDMA at Santiago State University.