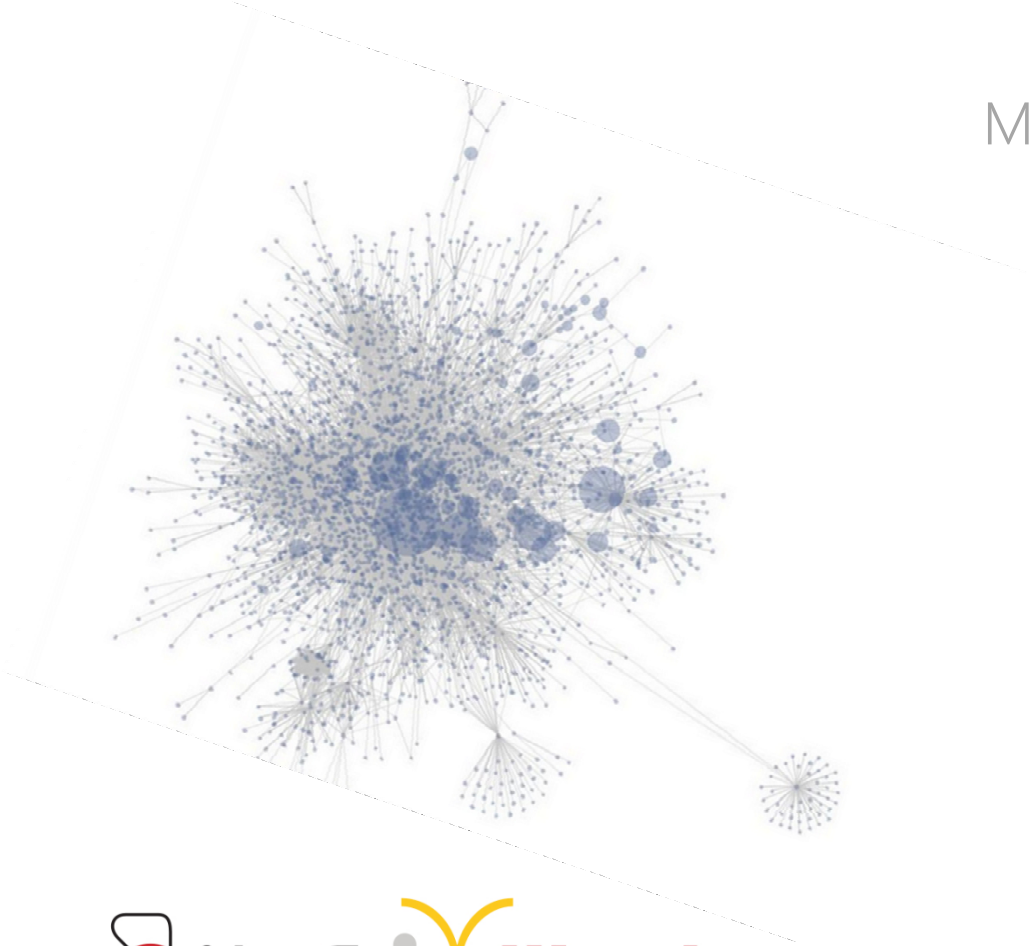
SOCIAL DIFFUSION MODELING OF THE DYNAMICS OF PREMIUM APP PURCHASES



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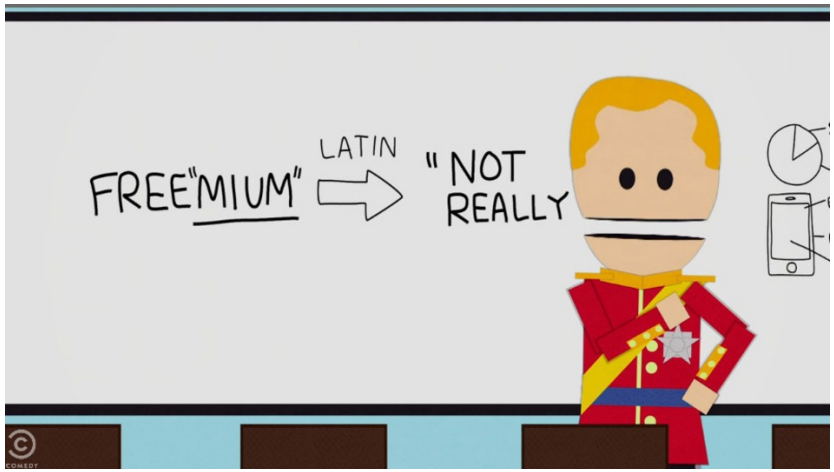
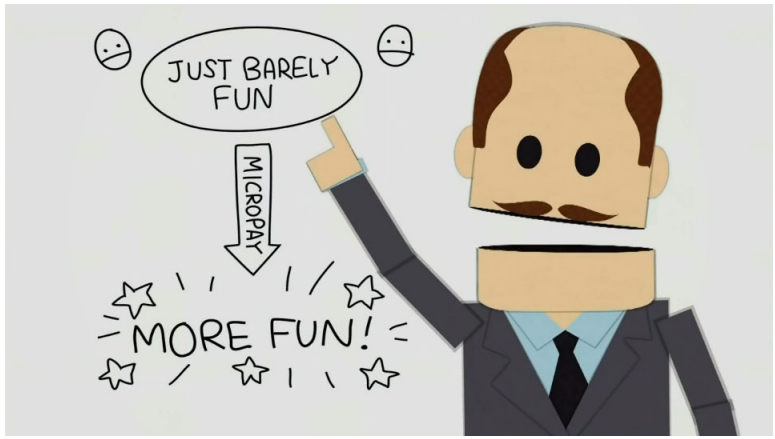
Freemium business model

A freemium business model offers a service/product free of charge but a premium is charged for advanced features, functionality, or related products and services [Hayes08, Anderson09]



South Park. Season 18, episode 6:
Freemium isn't free



Animal Jam application

A freemium online social game for kids. Company provided us with real data of the social network (snapshot) and daily premium conversions.

Marketers wanted to understand social influence and evaluate the best marketing strategies to expand the market.

Modeling objectives

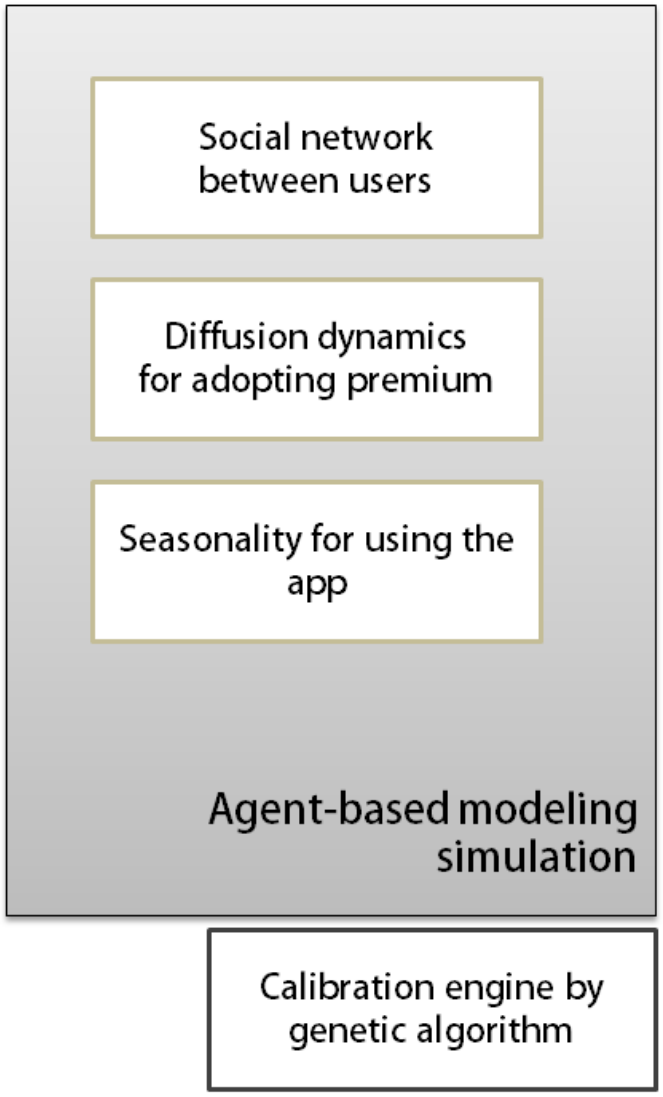
Present a general model for social adoption of premium contents.

Adapt it for Animal Jam app and find the best diffusion model.

Understand users adoption and social influence of their friends. Previous works showed social influence importance [Kumar14, Bapna15].

Forecast premium conversion over time, useful for creating DSS for marketing policies and what-if scenarios.

Components of the general model



ABM simulation

Agents can have two states: free or premium.

ABM simulation generates daily premium conversions, starting with an initial rate of premiums according to app data (α).

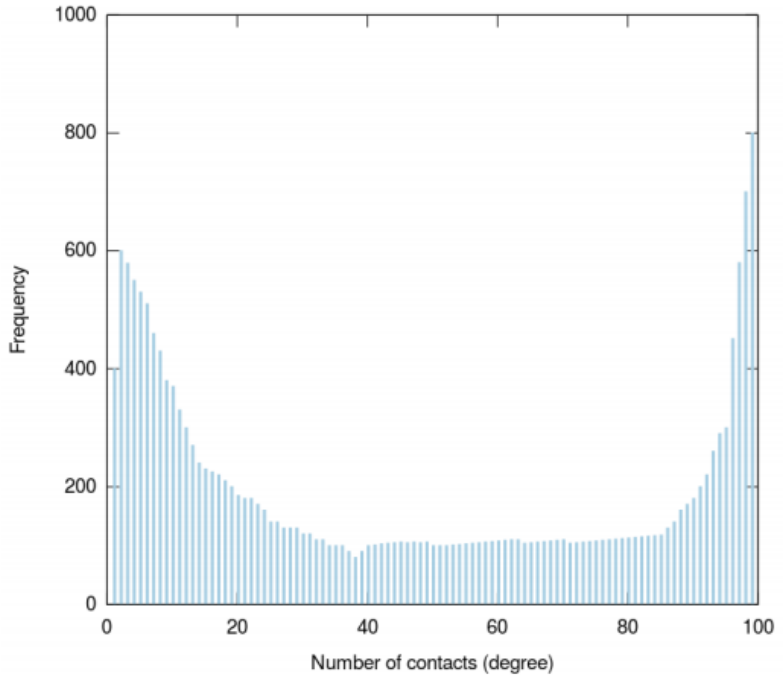
Granularity: All agents can make decisions every day and the simulation is asynchronous.

Seasonality: each agent, before making decisions, can use the app or not by a probability. For AJ, we considered two: playing during weekends and weekdays.

Social network generation

Agents are linked by a social network. In the case of the AJ, this is limited to a max. of 100 friends.

Instead of using approximated random networks (SF or ER) we use a generalized random network algorithm to create a social network with the same degree distribution.



Efficient generator of graphs with prescribed degree sequence [Viger05].

Bass diffusion model

Agent-based Bass model: an agent can adopt the premium content by innovating or by imitating (friends of the social network) [Bass69, Rand11].

$$p + q(n_a/n)$$

Innovation coefficient *p:* to adopt because of external effects (ads, media, outside the social network).

Imitation coefficient *q:* to become premium by observing friends where n_a/n is the fraction of friends already premium.

Complex diffusion model

We also develop a complex contagion model based on the idea that a contagion requires an individual to have contact with 2 or more sources [Centola07].

Complex contagion is similar to the threshold model (adoption above a threshold ϕ). Its difference resides on taking into account the sources (a_i) (not the exposures).

$$Pr[adopt] = \begin{cases} 1 & \text{if } a_i \geq \phi, \\ 0 & \text{if } a_i < \phi. \end{cases}$$

Models calibration

ABM simulation (20,000 agents within a social network with same degree distribution) by considering two different sub-models: Bass & Complex.

A hold-out approach: 2 months for training and 1 month for test.

We employ a Genetic Algorithm [Back97] to calibrate the model parameters (historical match using the Euclidean distance):

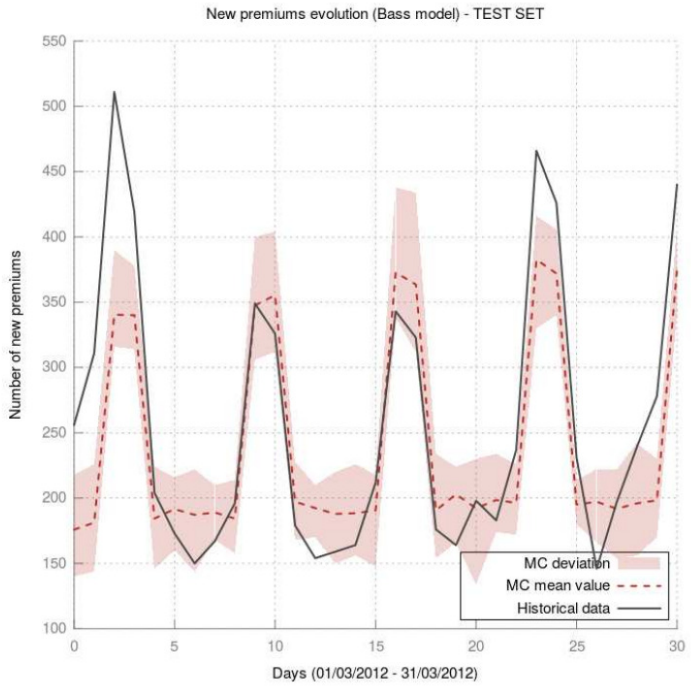
p = 0.034 q = 0.152

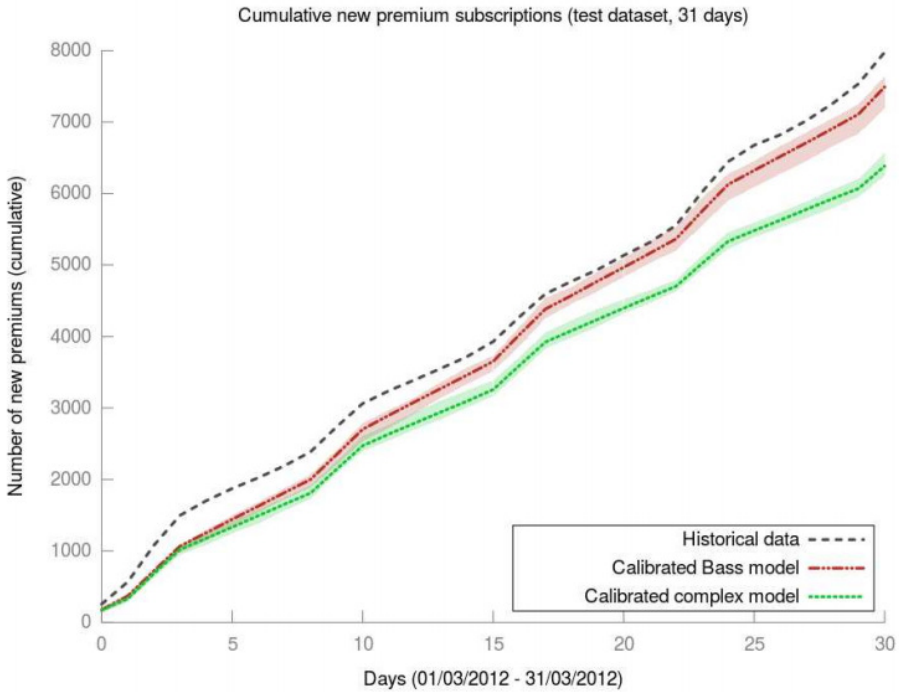
Complex threshold : > 3 friends

Prob. Weekends >> Prob. Weekdays

Macro-level forecast results

Bass model fits slightly better for TRA and TST data (60 and 31 days).





Final remarks

The goal was to provide with a model to understand how users of social apps purchase premium contents.

We applied and calibrated it to the Animal Jam app.

We found that Bass fits better macro-level forecast than complex contagion.

These models can be useful for building DSS for marketers and practitioners: testing different rewarding and targeting policies.

THANKS FOR YOUR ATTENTION

Be always positive, it could be worse …

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