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Human Computation Game for Enhancing Movie Box Office Prediction Model

Johmphot Tantawichien[*1] Hajime Mizuyama[*1] Tomomi Nonaka[*1]

[*1] Aoyama Gakuin University

Decisions made in movie production are difficult to reverse and will possibly affect marketability of the movie. Movies are perceived differently by each group of audiences. To improve marketability, the movie must have some aspects to attract audiences. Previous study has proposed various methods for box office prediction but none has considered movie production as a continuous process nor using a game as an approach. In this study, we propose a crowdsourcing game which would be more suitable to determine subjective factors. Players have to invest and generate revenues from movie projects with limited information. The game is used in combination with mathematical model to enhance its performance. The combination model can continuously evaluate current situation and what-if scenarios for the duration of movie production. We intend to explore how to combine both methods together and benefits of combination model.

1. Introduction

Movies are creative products which vastly different from each other. Audiences also have differences in preferences, appeal and quality they expect from movies. Critical-acclaimed movies might not be successful financially as suggested that popular appeal of crowd does not always agree with critical ratings [Holbrook 1999] and lack of strong correlation between critical rating and box office revenue [King 2007] but a few low budget movies can benefit from additional exposure from positive critical ratings [Gemser 2007].

Therefore, decisions making is challenging due to uncertainty and artistic quality of movies. A lot of decision choices are subjective. Any decision changes might find troubles from time, legal or production constraints. Each decision might affect the quality and marketability of movies. To make right decisions for movie production, producers or directors need to consider how to attract and sell their movie to audiences and which aspects of movies should be used to succeed their goals.

Researchers tried to create models to predict the box office revenue from various sources, for example, financial data and metadata [Lash 2016], Wikipedia activity level from editors and viewers [Mestyán 2012], movie scripts analysis [Eliashberg 2014], search volume [Panaligan 2013], prediction market [Doshi 2010] [Gruca 2003] or combination of metadata, financial and social media [Krauss 2008]. However, prior studies on movie box office prediction either focused on early or later phase at a single point of time where each has its own shortcomings; missing factors in later phases for early phase study and not useful for decision making for late phase study.

Many related studies use Hollywood Stock Exchange (HSX) which is a prediction market that let people invest in movie-related stocks using game money. While many studies agreed that HSX has a good predictability, it still has some flaws. Players are influenced by stars' popularity but overlook some genres and competitions [Karniouchina 2011]. From using game money, players also tend to gamble [Gruca 2003]. We are interested to make a human computation game for movie box office prediction but players would play as investors instead.

In this study, we propose a combination model using a human computation game to enhance mathematical model performance. We consider movie production as a continuous process and more information about the movie will gradually available as the production progresses. We also want to explore how to combine mathematical model and game together and its benefits over an individual mathematical model. The proposed models can be used for evaluating current situation or what-if scenarios before planning or any further actions.

Contact: Johmphot Tantawichien, Mizuyama Laboratory, Aoyama Gakuin University, johmphot@gmail.com

2. Proposed Models

2.1 Mathematical Basis Model

For this study, we use mathematical model as a basis. Unlike prior studies, we consider movie production as a continuous process that need to be supported from start until end. In this case, the information that available earlier is considered to be more valuable for decision making than information that gain in later phases as many decisions have to be made in pre-production phase. To address this challenge, instead of creating a model at a single point of time, we choose to create multiple models at different time with more information added as the movie production progresses (Figure 1). The data is gathered from IMDb, Box Office Mojo, and Wikipedia.

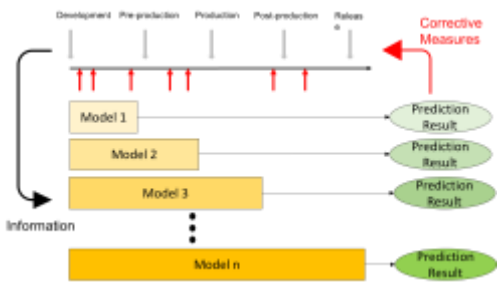

Figure 1 The model continuously gains information and the result can be used to support decision making.

2.2 Human Computation Game

Human computation game in this study is an investment game which players can invest in movie projects based on information about the movie. The objective of the game is to gather opinions about the potential of the movie and what information is crucial for decision making based on human judgement.

Players in this game are normal moviegoers (went to theater at least once a year) and frequent moviegoers (went to theater at least once a month). While only 10% of U.S./Canada population are frequent moviegoers, they accounted for 49% of tickets sold in 2015 [MPAA 2015]. We target players of this game to be about 50:50 for frequent versus normal moviegoers.

Initial resources (cash and information gold) will be given to players at the beginning. Cash is used for investing. Information gold is used for revealing information about the movie and will be given periodically. To win the game, players have to maximize their cash by investing in movie projects, given limited information at each phase.

The game should not encourage players to use all-in strategy which is a strategy when players put all of their resources into a single bet (in this case, a high budget movie project) and hope that a bet will turned out to be good. At the end, players will either win by a large margin or lose horribly, depends solely on how their single bet performs. To handle this problem, the game will be played in a time period with movie projects scattered along the timeline.

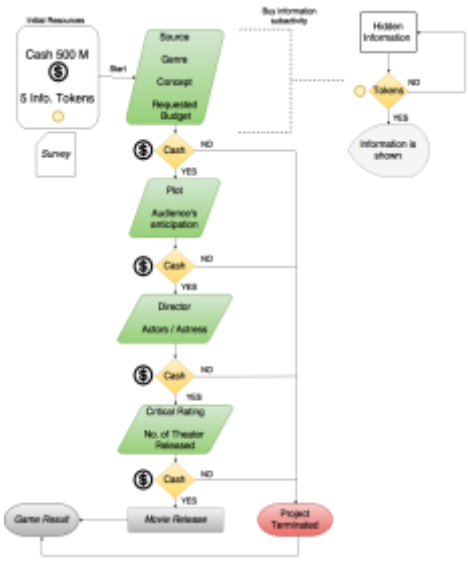

Figure 2 A detailed game flow of a single movie.

In the single player game (Figure 2), movie projects will be offered to players. Players can see initial information about the movie. If players are interested in a particular movie project, they can initiate a movie project by paying cash and become a project owner. Once the movie project is initiated, that movie project will progress into different phases and player (now the owner) is required to invest more cash to get the movie project to the next phase and more information will be given to players at each phase. If player choose not to invest more or unable to pay a required amount, the movie project will be terminated from player's portfolio and players will lose the money that they have invested in that project. Players are not allowed to reinvest in terminated movie projects, reverse to previous phases, or change their previous decisions. If the movie project is completed, the project owner will get revenue from that project, calculated from mathematical basis model.

From the game, we can gather game activities of players for further analysis. We can analyze what movie projects players are likely to invest, what information players are likely to see first, and what set of information players find good enough for decision making.

3. Model Enhancement Using Human Computation Game

While mathematical models are suitable for objective factors, subjective factors have to be quantified first before putting in the model. Thus, different methods might affect the accuracy of models with bias from modelers' methods. In our study, the main motivation of using human computation game is to evaluate subjective factors from customer's perspective and combine the result with that of mathematical model.

Previous studies suggested that the combination models can improve accuracy of the model and reducing uncertainty and bias from modelers [Chase 2000][Delen 2008]. Another study suggested to combine five or more methods when feasible and draw data from different sources to reduce bias [Armstrong 2001]. However, there is not any previous attempt to incorporate human computation game with mathematical models.

Our hypothesis is human computation game should be able to enhance the performance of mathematical models by addressing subjective factors that are difficult to quantify. In this study, we attempt to analyze the game data on which project they invest and which information they need to make a decision. The data can be used for variable selection and make a comparison between game-based subjective variable selection and pure mathematical approach. The intended result of this study is to determine whether human computation game can enhance mathematical prediction models and how to combine results from the game and mathematical models together.

4. Conclusion

Making decisions for movie production is a challenge due to the difficulty to revert decisions and subjective appeal of movies. The previous studies have proposed various methods to predict box office performance but the movies are usually evaluated at a single point of time and there is no previous attempt to use a game to enhance model's performance. In this study, movie production is considered as a continuous process and more information will be available as the production progress. We propose a combination model which uses a human computation game to improve the performance of mathematical basis model and reduce bias from quantification methods by using gameplay data. We intend to study how the game can be used to enhance mathematical models and the method to combine both together.

References

[Holbrook 1999] Morris B. Holbrook: Popular Appeal versus Expert Judgments of Motion Pictures, Journal of Consumer

Research, Vol. 26, No. 2, pp.144-155, Oxford University Press, 1999.

[King 2007] Timothy King: Does film criticism affect box office earnings? Evidence from movies released in the U.S. in 2003, Journal of Cultural Economics, Vol. 31, No. 3, pp.171-186, Springer, 2007.

[Gemser 2007] Gerda Gemser, Martine Van Oostrum, Mark A. A. M. Leenders: The impact of film reviews on the box office performance of art house versus mainstream motion pictures, Journal of Cultural Economics, Vol. 31, No. 3, pp.171-186, Springer, 2007.

[Lash 2016] Micheal T. Lash, Kang Zhao: Early Prediction of Movie Success: The Who, What, and When of Profitability, arXiv preprint arXiv:1506.05382v2, 2016.

[Mestryán 2012] Márton Mestyán, Taha Yasseri, János Kertész: Early Prediction of Movie Box Office Success based on Wikipedia Activity Big Data, arXiv preprint arXiv:1211.0970, 2012.

[Eliashberg 2014] Jehoshua Eliashberg, Sam K. Hui, Z. John Zhang: Assessing Box Office Performance Using Movie Script: A Kernel-Based Approach, IEEE Transaction on Knowledge and Data Engineering, Vol. 26, No. 11, pp.2639-2648, IEEE, 2014.

[Panaligan 2013] Reggie Panaligan, Andrea Chen: Quantifying Movie Magic with Google Search, Google Whitepaper Industry Perspective + User Insights, Google, 2013.

[Doshi 2010] Lyric Doshi: Using Sentiment and Social Network Analyses to Predict Opening-Movie Box-Office Success, Master's thesis, Massachusetts Institute of Technology, 2010.

[Krauss 2008] Jonas Krauss, Stefan Nann, Daniel Simon, Kai Fischbach, Peter Gloor: Predicting Movie Success and Academy Awards Through Sentiment and Social Network Analysis, ECIS, 2008.

[Gruca 2003] Thomas S. Gruca, Joyce Berg and Michael Cipriano: The Effect of Electronic Markets on Forecasts of New Product Success, Information Systems Frontiers, Vol. 5, pp. 95-105, Springer, 2003.

[Karniouchina 2011] Ekaterina V. Karniouchina: Are Virtual Markets Efficient Predictors of New Product Success? The Case of the Hollywood Stock Exchange, Journal of Product Innovation Management, Vol. 28, pp. 470–484, Wiley, 2011.

[MPAA 2015] Motion Picture Association of America: Theatrical Market Statistics 2015, 2015.

[Chase 2000] Charles W. Chase Jr.: Composite Forecasting: Combining Forecasts for Improved Accuracy, Journal of Business Forecasting Methods & Systems, Vol. 19, pp.2-22, Graceway, 2000.

[Delen 2008] Dursun Delen, Ramesh Sharda: Predicting the Financial Success of Hollywood Movies Using an Information Fusion Approach, Journal of Industrial Engineering (Turkish Chamber of Mechanical), Vol. 21, No. 1, pp.30-37, Turkish Chamber of Mechanical, 2008.

[Armstrong 2001] J. Scott Armstrong: "Combining forecasts", Marketing Papers, University of Pennsylvania, 2001.