

Report on the Third Working Group Meeting of the AG Marketing

Friederike Paetz and Daniel Guhl

Abstract This article reports on the third working group meeting of the AG Marketing within the GfKI Data Science Society. The meeting was held online as part of the DSSV-ECDA 2021 conference from July 7 to 9, 2021, hosted by the Erasmus University Rotterdam. The presented talks included topics from a great variety of fields from quantitative marketing, such as marketing modeling as well as retailing and digital marketing.

Friederike Paetz
Technical University Clausthal, Julius-Albert-Str. 6, D-38678 Clausthal-Zellerfeld Germany
✉ friederike.paetz@tu-clausthal.de

Daniel Guhl
Humboldt University of Berlin, Spandauer Str. 1, D-10178 Berlin Germany
✉ daniel.guhl@hu-berlin.de

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Introduction

Due to the ongoing COVID-19 pandemic and its' related issues concerning traveling and face-to-face meetings, we decided on a fully digital format for the third working group meeting of AG Marketing. We were very happy for the opportunity to include our meeting in the DSSV-ECDA 2021 conference. A combined virtual event of the conferences Data Science, Statistics & Visualisation (DSSV) and the European Conference on Data Analysis (ECDA) that was hosted by the Erasmus University Rotterdam, in the Netherlands. The conference was well organized, and we would like to express our special thanks to the conference organizers who did a fantastic job!

Besides 2 sessions of the annual working group meeting of AG Marketing, additional marketing-related sessions were part of the conference. One session entitled Predicting and Optimizing Marketing Performance in Dynamic Markets (organized and chaired by Friederike Paetz and Daniel Guhl) was an invited session with international marketing researchers, specifically Norris Bruce (UT Dallas), Robert Rooderkerk (Erasmus University), and Sahar Hemmati (University of Maryland). Furthermore, the renowned quantitative marketing researcher Michel Wedel from the University of Maryland gave a keynote entitled Statistical Analysis of Eye Movements during Visual Search and Choice (chaired by Friederike Paetz). The keynote and the sessions attracted a large audience of marketing researchers and we are very satisfied that we were able to promote marketing-related topics as part of the conference.

Despite the spatial distance between participants, the meeting of AG Marketing sparked stimulating discussions about exciting presentations from varying fields of quantitative marketing. We were pleased to welcome new faces and were very happy to see and chat with our familiar working group members. We want to thank all participants of the marketing sessions sincerely.

Six presentations (two sessions with three talks each) were selected and part of the AG Marketing meeting. The presentations covered different fields and topics of quantitative marketing. This first session included talks about marketing modeling and methods: Muhammad Shuaib Aslam proposes new convolutional neural networks based on transfer learning models and demonstrated their superiority based on the Fashion-MNIST benchmark dataset. The models achieved competitive results and outperformed some previous transfer learning methods in literature (Aslam, M.S, Baier, D.). Narine Yegoryan focuses on

using incentive-aligned choice-based conjoint analysis with lottery rewards and investigates the effect of varying realization probabilities and ambiguity on outcomes related to consumers attention and external predictive validity (Yegoryan, N.). Ulrich Müller-Funk rethinks the popular Bass model and discusses critically potential flaws of the model (Müller-Funk, U., Wilken, R., Backhaus, K., Eisenbeiss, M.).

The second session covered retailing, marketing modeling, and digital marketing: Mareike Sachse investigates the effect of assortment sizes on sales combined with price promotions (Oetzel, S., Sachse, M., Klapper, D.). Nadine Schröder investigates different types of structural equation modeling models' misspecification assessments and establishes three main contributions that help advance prior work on model misspecifications in SEM (Schröder, N., Falke, A., Endres, H.). Carsten D. Schultz contributes to a deeper understanding of digital voice assistants competitive situations and aims to investigate market determinants and to provide decision support for digital business models (Schultz, C.D., Paetz, F.). Below we present the abstracts of the talks presented at the third working group meeting of the AG Marketing.

1 Fashion Article Classification through Convolutional Neural Networks Based on Transfer Learning

Muhammad Shuaib Aslam, Daniel Baier

Product image classification is a topic within the larger research field of object detection and feature extraction in computer vision. Nowadays, this topic receives more and more attention in the fashion industry due to promising applications in the selling process where article retrieval and recommendation based on uploaded product images by customers is needed or in the logistic process where article categorization based on photographed products is needed (see, e.g. Seo and Shin (2019)). So, e.g., when customers return ordered but disliked articles, the retailers have to categorize the returned articles and to initiate further handling steps based on this categorization. Here, automated image classification is a welcome support: The returns are photographed and article and quality categories are derived from these images by traditional machine learning and image processing methods as well as deep learning approaches.

In this paper, we propose new convolutional neural networks based on transfer learning models for this purpose and demonstrate their superiority with respect to a benchmark dataset for this purpose, the well-known Fashion-MNIST dataset (see Xiao et al (2020)). We apply our models on different image resolutions such as 48 x 48 and 96 x 96 to conduct a comparative analysis on the performance of all models. Moreover, we apply random erasing data augmentation with a combination of classic affine transformations such as flipping, rotation, etc. to improve the generalization capabilities of our models. Our proposed models are capable to achieve competitive results and outperform some previous transfer learning methods proposed by others (Pillai and Sreekumar (2021b), Rawat et al (2020b)).

2 Lottery Rewards in Incentive-Aligned Choice-Based Conjoint Studies

Narine Yegoryan

The use of incentive alignment mechanisms in choice-based conjoint (CBC) studies has become state-of-the-art. Incentive alignment aims at inducing respondents to state their true preferences and reduce the hypothetical bias, leading to higher external validity and more realistic willingness-to-pay measures. Irrespective of the specific incentive alignment mechanism used to reduce high implementation costs, lottery rewards are often employed, i.e., respondents' choices are consequential at the realization probability r , where $0 < r < 1$. In theory, any positive r should induce truth-telling (Ding 2007). However, recent studies find that the performance of incentive-aligned CBC depends on the realization probability r such that higher r leads to more attention to the choice-relevant information (Yang, Toubia, and De Jong 2018) and demand forecasting (Cao and Zhang 2020). At the same time, in the context of choice of fast-moving consumer goods, (Yang et al. (2018)) find that respondents are insensitive to very small realization probabilities (e.g., 1%). Moreover, there is variation across the studies in how the realization probability is communicated to the respondents. While some studies provide objective chances of winning (e.g., "1 in X chances"), some use intervals (e.g., "1 in X to Y") or ambiguous prospects (e.g., "1 lucky winner"). It is not necessarily obvious how the introduction of ambiguity in the incentive may affect the outcomes of incentive-aligned

CBC. On the one hand, ambiguity aversion and uncertainty effect may hinder the effectiveness of ambiguous prospects in incentive-aligned CBC. On the other hand, in the face of uncertainty, optimism may come into play. This study specifically focuses on the use of incentive-aligned CBC in the context of durable goods, where the budget often binds researchers to offer very low (e.g., 1 % and lower) realization probabilities. It aims to investigate

1. whether similar patterns in outcomes of CBC (e.g., attention, external predictive validity), as found in previous literature, are observed in the case of marginal increases in the realization probability, and
2. the effect of ambiguity in the provided incentives on the performance of incentive-aligned CBC.

3 Product Diffusion: Statistical Analysis via Counting Processes

Ulrich Müller-Funk, Robert Wilken, Klaus Backhaus, Maik Eisenbeiss

The seminal paper by (Bass (1969)) on product diffusion has generated a rich stream of follow up studies covering all kind of questions. However, we feel that modelling paradigms underlying the bulk of these papers need a rethinking. The predominant device of predicting sales is based on smooth, numerical models: Randomness is disregarded, forecasting amounts to the extrapolation of a proxy adapted to data collected hitherto. The product life cycle is ignored, the market potential becomes a deterministic parameter to be fixed at presence, the time of analysis. No thought is given to the question, how the resulting deterministic curve is exactly related to the sales process that is factually predicted that way. From a statistical point of view, this line of thinking is but bewildering. Alternatively, stochastic approaches to the problem are mostly tied up to Ornstein-Uhlenbeck-type processes, seemingly motivated by a vague similarity to events in physics or in finance. Sales processes, however, are discrete by nature, characterized by adoptions popping up at isolated random instants a structure completely brushed aside by this approach. Böker (1987) has been the only author classifying the topic into event history analysis, the

natural environment for modelling and analyzing chance dependent counts in time. See Ahlen et al (2008) for an account of the topic.

It is our intention to revive the counting process approach. With a view at applications, only the discrete time case is considered in the talk. Prediction is assumed to be on some instant within the life cycle and with a fixed time horizon, an aspect nowhere addressed. Three points render this problem hard. First, all data at hand is but the initial segment of the sales process, no replicas are available. Second, the process is non-stationary as it elapses in stages and, in addition, might feature unforeseeable phases. The third difficulty is that both the length of the durable's life cycle and its market potential are random and latent. The problem, accordingly, must be rephrased: What statistical forecasts can reasonably be waged at all? The talk touches upon the following steps:

- Multiplicative intensities of discrete counting processes.
- Discrete Bass family, Lorenz processes and restarting property.
- Determination of phases, estimation of hazards, prediction based on scenarios.

Given the data situation, there is no formalized quantitative way to assess any approach to the problem. We hope to provide a qualitative perspective on the aspect in terms of conceptual fit.

4 I'll try that, too – The Effect of Variety on Choice *Sebastian Oetzel, Mareike Sachse, Daniel Klapper*

There is a consensus that variety is generally a good thing for choice. However, a large body of literature has been supporting the notion that too many alternatives may result in choice overload, leading to a reduction of consumers choice satisfaction or choice deferral - up to the degree of not purchasing a product at all (cf. Chernev et al., 2015; Iyengar and Lepper, 2000). There has been little research on the effect of assortment sizes on sales combined with a price promotion and a second placement display so far.

This is of relevance for retailers: While a shrinkage in sales impacts profit, reducing the number of products may save costs as well (i.e. storage, supply chain; see Sloot et al., 2006).

In a field experiment with a major chocolate brand conducted at a German retail chain, we test for choice overload during a display promotion and price reduction. The stores in the control group offered 23 different 100g chocolates on promotion, while test stores displayed a reduced selection of 16 alternatives. We find a significantly positive effect of the display promotion and price reduction on unit sales in all groups but cannot confirm on choice overload on an aggregate level. Further findings show a change in preference order among alternatives during the promotion, only with the full range of alternatives, suggesting a higher willingness to try unknown/unpopular products. On a product level, we find a significant reduction in the promotion uplift for stores with less variety as well as a positive impact of the number of facings on the display. We contribute to the literature on choice overload by offering insights from actual purchase decisions with store-level scanner data that consider more alternatives than most experimental studies and by examining the impact on preferences within a choice set. In addition, we examine this effect during a price promotion and second placement display.

5 Keep the Baby Even Without the Bath Water: Context-Specific Fit Criteria for Confirmatory Factor Analysis & Covariance-Based Structural Equation Models

Nadine Schröder, Andreas Falke, Herbert Endres

Structural equation modeling (SEM) techniques, including confirmatory factor analysis (CFA) and covariance-based structural equation models (CBSEM), are widely applied in survey research (Hulland, Baumgartner, and Smith 2018). Yet despite its popularity and widespread use, SEM is at risk of model misspecification, which can produce incorrect conclusions and missed insights. Methodical studies note that assessing model misspecification still remains a fundamental and practical issue for (marketing) researchers.

With this study, we seek to assess model (mis)specification with the help of global and local fit criteria, while considering various experimental factors in two Monte Carlo simulation studies. Existing assessments of available criteria tend to focus on error rates, i.e., how many incorrect decisions the models

produce, whether by improperly rejecting a good model or accepting a poor one (e.g., Hu and Bentler 1999).

In this effort, fit criteria (and their combinations) provide a classification task, involving classifying each model as either misspecified or correctly specified. But as studies in various domains show, it also is necessary to consider the precision of the employed fit criteria.

By investigating both types of assessments, we establish three main contributions that help advance prior work on model misspecifications in SEM. First, we reveal that existing recommendations for combining fit criteria only marginally address model (mis)specification. They accept many misspecified models and reject too many correctly specified models, resulting in low precision. Second, we find that the ability of fit criteria to detect misspecification differs between CFA and CBSEM. Third, we challenge a one-size-fits-all approach. We, therefore, propose context-specific criteria combinations that accept more of the correctly specified models than existing combinations do, while also rejecting the majority of misspecified models. By applying specific, appropriate criteria combinations, (marketing) researchers can avoid losing important insights and also gain further information from their data, using both CFA and CBSEM.

6 Decision Support for Digital Business Models: An Empirical Study on Users Preferences for Digital Voice Assistants

Carsten D. Schultz, Friederike Paetz

Digital voice assistants are emerging as a pervasive technology with the potential to transform entire business processes and models. Amazon's Alexa, Apple's Siri, Microsoft's Cortana, Google's Assistant, and Samsung's Bixby are examples of such digital voice assistants that can interpret human speech and respond via synthesized voices. Digital voice assistants are used primarily in smartphones and smart speakers but are also becoming more ubiquitous in other technological applications. Voice recognition and control is seen as the primary operation form in the future, as voice commands offer an intuitive, verbal way of interacting with technical devices without haptic contact. In the wake of digitization and artificial intelligence, companies are increasingly relying on this technology by automating business processes on a rule-based basis.

Digital voice assistants can naturally extend to service situations, for example, in call centers (Schultz 2021). When digital voice assistants are used for purchasing (Moriuchi 2019; Rese et al. 2020), they can have a significant impact on competition. This is particularly true when voice assistants restrict access to selected products or retail platforms. For example, Amazon's Alexa primarily accesses Amazon as a retail platform (and the products offered there) and thus excludes other platforms, such as Alibaba or Walmart.

Digital voice assistants function as intermediaries that can consequently trigger significant distortions and upheavals in market activity. Previous research has primarily focused on technical developments of digital voice assistants. In contrast, few studies address user preferences for digital voice assistants (e.g., van Doorn et al. 2017; Ewers et al. 2020).

This is particularly surprising considering their potential effect on market competition. For example, brand preferences of digital voice assistants can significantly influence digital business models of both digital voice assistant providers and electronic retailers. Users preferences, e.g., for certain brands, also lead to different segments that subsequently affect their user behavior.

Consequently, the aim of our study is to gain a deeper understanding of digital voice assistants' competitive situation. Hereby, we aim to investigate market determinants and provide decision support for digital business models. With our contribution, we close this research gap:

Based on the results of a discrete choice experiment on smart speakers, we show, among other things, brand effects on digital voice assistants and discuss the associated influence on market competition. Our representative German sample includes individual choice decisions of 350 subjects. Based on a state-of-the-art discrete choice model, we identify five user segments that differ significantly from each other in terms of their preference structures. These differences in preference can impact market activities, including for example market competition and purchasing behavior, and determine the future development of digital business models. This primarily applies to providers of digital voice assistants and to retailers and manufacturers who digitally realize their transactions.

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