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Research Spotlights

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Fairness of Ratemaking for Catastrophe Insurance: Lessons from Machine Learning (p. 469)
Nan Zhang, Heng Xu

A hallmark of information technology use in disaster management is the wide adoption of complex information systems for risk assessment, portfolio management, and ratemaking in catastrophe insurance. Whereas the importance of catastrophe insurance to disaster preparedness is beyond dispute, catastrophe insurers are increasingly reckoning with the potential impact of inequality in insurance practices. Historically, the presence of inequalities in insurance, from redlining to pricing disparity, has had a devastating impact on minority communities. Even recently, people living in predominantly African American communities can still be charged more for the same insurance coverage than people living in other communities. Whereas the fairness of insurance ratemaking is studied in general, we identify a unique challenge for catastrophe insurance that sets it apart from other lines of insurance. Drawing upon the recent advances in machine learning for fair data valuation, we reveal striking connections between the two seemingly unrelated problems and lean on insights from machine learning to study the fairness of ratemaking methods for catastrophe insurance. Our results indicate the potential existence of disparate impact against minorities across existing methods, pointing to a unique solution that can satisfy a few commonly assumed properties of fair ratemaking for catastrophe insurance.

Smart Natural Disaster Relief: Assisting Victims with Artificial Intelligence in Lending (p. 489)
Yidi Liu, Xin Li, Zhiqiang (Eric) Zheng

Natural disasters can have devastating economic and financial consequences for those affected. This research note explores the potential of artificial intelligence (AI) in disaster relief through lending services. By collaborating with a credit-scoring company, we investigate how AI-empowered lenders can effectively reduce delinquency rates for borrowers in the aftermath of disasters. Our findings reveal that borrowers applying to lenders that utilize AI in their loan assessment process experience improved outcomes in terms of delinquency reduction, particularly for borrowers with lower credit scores. This research underscores the positive impact of AI in the lending context, benefiting both lenders and borrowers. Furthermore, we highlight that AI indirectly supports disaster relief efforts through financing, providing a compelling use case for AI fairness in lending. Our findings have significant implications for leveraging AI as a valuable tool in mitigating the financial impact of disasters and promoting fairness in lending practices.

Resilience Messaging: The Effect of Governors' Social Media Communications on Community Compliance During a Public Health Crisis (p. 505)
Reza Mousavi, Bin Gu

Breaking new ground in crisis management, our study unveils the game-changing power of social media for community leaders. Scrutinizing social media posts from U.S. governors and supported by controlled experiments, we've delivered tangible tips for supercharging their messages, increasing effectiveness by 12%. Wondering how we gauge effectiveness? It's all about the community heeding government advice. Picture a governor issuing a hurricane warning on Twitter, urging locals to take cover or flee. Our study reveals a secret weapon for boosting compliance: embedding resilience in social media messages. This approach enables leaders to convince residents taking shelter or evacuating, a potentially lifesaving tactic in our era of escalating natural disasters. The benefits don't stop at safety. Leaders wielding resilience messages can also win hearts, earning themselves a reputation as charismatic inspirations in their community. Saving lives and gaining popularity at the same time! Harnessing cutting-edge large language models (i.e., ChatGPT and its AI siblings), we developed a tool for leaders to analyze content and craft effective social media posts for crisis management before going live. Give it a whirl at https://huggingface.co/spaces/paragon-analytics/ResText.

Proactive Resource Request for Disaster Response: A Deep Learning-Based Optimization Model (p. 528)
Hongzhe Zhang, Xiaohang Zhao, Xiao Fang, Bintong Chen

In the realm of disaster response operations, effective resource management is crucial. This research introduces an innovative approach that proactively determines the optimal quantities of resources that should be requested by local agencies. This determination is based on both current and anticipated demands, thereby ensuring a more efficient and effective response to disasters. The approach first utilizes a method that combines deep learning and temporal point process for predicting irregularly spaced future demands, and then, it formulates the resource allocation problem faced with randomly arrived demands as a stochastic optimization model. The superiority of this approach over existing resource allocation methods is demonstrated using both real-world data and simulated scenarios. The findings highlight the need for a shift from reactive to proactive strategies. Moreover, the research emphasizes the potential of advanced techniques, such as deep learning and stochastic optimization, in disaster management. These techniques can provide valuable tools for policy makers and practitioners in the field, enabling them to make more informed and effective decisions. Policies that encourage the adoption of such optimized resource allocation strategies could lead to more effective disaster response operations.

Speak with One Voice? Examining Content Coordination and Social Media Engagement During Disasters (p. 551)
Changseung Yoo, Eunae Yoo, Lu (Lucy) Yan, Alfonso Pedraza-Martinez

Disaster relief organizations (DROs) use social media to share information rapidly and broadly. Many DROs maintain multiple accounts on the same social media platform. Each account represents a different operational entity of a DRO, such as its national headquarters or a local branch. An important problem that DROs with multiple accounts face is how to coordinate the production of social media content across these accounts. One strategy is to have all accounts within the same DRO match their decisions about how content is created and designed (e.g., audience, topic). An alternate strategy is to mismatch these decisions. Using Twitter data collected in partnership with the Canadian Red Cross, we analyze which coordination strategy is best for social media engagement. Our results suggest that, during the immediate aftermath of a disaster, accounts within the same DRO should produce content with similar characteristics by matching their content creation decisions. This leads to a 4.3% lift in engagement. However, when DROs start working on helping impacted communities recover from disasters, engagement is 29.6% higher when their accounts mismatch their content creation decisions and post distinctive content.

Leveraging the Digital Tracing Alert in Virus Fight: The Impact of COVID-19 Cell Broadcast on Population Movement (p. 570)
Anindya Ghose, Heeseung Andrew Lee, Wonseok Oh, Yoonseock Son

Digital tracing alerts (DTAs) have emerged as effective means to share information with agility in responding to disaster outbreaks. Governments are able to instantaneously coordinate the available information to provide information related to the disaster and promote preventive actions. However, despite the opportunities granted by these innovative technologies in managing disasters, privacy concerns can arise in regard to how much of individuals' private information should be collected and disclosed. With these considerations, we examine the extent to which instant digital tracing alerts and the information included in the alerts affect people's actions toward disaster management in the context of South Korea. Our results show that collecting and disclosing detailed private information is unnecessary and may instead diminish the effects of DTAs. The effect of digital alerts being more pronounced among young and male individuals and in business-centric areas. Furthermore, because the effectiveness of DTAs decreases with the cumulative number of DTAs received, governments should send alerts that include more urgent information that is directly related to the risk posed by a disaster. Our results provide policymakers and law enforcement with novel insights into whether and how the usage of information technology can facilitate disaster management and to what extent they should collect and expose private information to effectively safeguards public health and safety during a crisis. The fast and comprehensive implementation of DTAs in South Korea in response to the global outbreak offers other countries learning opportunities with respect to successful collaboration among parties involved in the development and design of DTA-related infrastructure and education. We emphasize that collaboration among central policymakers, local/municipal districts, telecommunications companies, and healthcare centers is essential to establishing an innovative IT-driven disaster management infrastructure and mechanisms that help inform citizens in taking desired actions in an emergency or disastrous events.

management schools. First, managers trying to exploit peer-to-peer learning as a way to train workers ought to be aware that negative messages could be transmitted along with positive ones, leading to productivity loss. Second, we highlight that peer influences are important when managers in emerging economies choose their occupations and industries. Managers seeking to attract more talent to the IT industry should keep this channel in mind while designing recruitment strategies.

The Scope of Software Patent Protection in the Digital Age: Evidence from *Alice* (p. 657)
Yu-Kai Lin, Arun Rai

Previous studies on software patents using data from the 1990s and early 2000s found a positive association between strong patent rights and sales within the software industry. Our research expands on this work in three ways. First, we consider more recent data from 2010 to 2018, which better represent the advancements in digitalization. Second, we shift our focus to the breadth of software patent protection rather than the quantity of patents held by a firm. Third, we provide evidence showing increased open-source involvement and sales for software firms when software patent protection is more limited. Put simply, a more restricted scope of software patent protection could foster a beneficial situation for both software firms and society. Despite less reliance on formal patent protection, companies can still generate and profit from their innovations without excluding societal members from utilizing these advancements. This "less-is-more" approach may extend to a wider array of software-related innovations, including but not limited to artificial intelligence, blockchain, and other emerging digital technologies.

Strategic Implications of Online Retail Platforms' Membership-Based Free Shipping Programs (p. 673)
Geng Sun, Huseyin Cavusoglu, Srinivasan Raghunathan

Product shipping is a critical yet expensive aspect of online retail. A significant innovation in this area is the membership-based free shipping (MFS) program, under which an online platform offering third-party sellers the opportunity to sell products for a commission absorbs shipping costs for purchases made by members who pay an up-front fee. Our analysis identifies several strategic impacts of MFS programs that contribute to their success from various stakeholders' perspectives. Notably, the membership fees do not cover the platform's shipping costs, suggesting that while MFS benefits members, it is disadvantageous for the platform if evaluated solely on direct operational costs. However, the platform benefits when shipping costs fall below a certain threshold, and its gains from the MFS program peak when shipping costs are moderate. Although MFS increases overall consumer demand and consumption, it may harm society by encouraging demand among consumers whose consumption utility is low compared to the shipping cost. Thus, the MFS program is more than just a cost transfer mechanism, rather it is a strategic initiative by online platforms to leverage shipping needs to their advantage.

Transporting Causal Effects Across Populations Using Structural Causal Modeling: An Illustration to Work-from-Home Productivity (p. 686)
Sujin Park, Ali Tafti, Galit Shmueli

Transportability is a structural causal modeling approach aimed at "transporting" a causal effect from a randomized experimental study in one population to a different population where only observational data are available. It allows for extracting much more value from randomized control trials because under some conditions, it allows the estimation of causal effects in a target population where replicating the experiment is difficult, costly, or impossible. Despite the enormous economic and social benefits of transportability, it has thus far seldom been implemented in practice, likely because of the lack guidelines for applying transportability theory in practice and on handling the statistical challenges that might arise. Using a practical problem as an illustration—estimating the effect of telecommuting on worker productivity—we attempt to offer a detailed procedure for transporting a causal effect across different populations, and we discuss some practical considerations for its implementation, including how to conceptualize causal diagrams, determine the feasibility of transport, select an appropriate diagram, and evaluate its credibility. We also discuss the current limitations, challenges, and opportunities for future research on transportability that would make it more amenable for broad practical use.

Informal Payments and Doctor Engagement in an Online Health Community: An Empirical Investigation Using Generalized Synthetic Control (p. 706)
Qili Wang, Liangfei Qiu, Wei Xu

Recognizing the importance of doctor engagement in online health communities (OHCs), managers and platform owners seek to foster doctor-patient interactions and encourage doctors' knowledge sharing by introducing informal payments. This study investigates how informal payments in the form of monetary gifts affect doctor engagement, using the launch of a gifting feature by a leading OHC as a natural experiment that exogenously provides doctors with extra monetary incentives. We find that informal payments can have a crowding-out effect on doctors' intrinsic motivation to engage in medical consultations. We also find that monetary and

nonmonetary gifts play distinct roles in motivating doctor responses, with nonmonetary gifts having a more significant carryover effect on follow-up interactions and better promoting the doctor-patient relationship. Our findings additionally suggest that social status moderates the impact of digital gifting on doctor engagement. These findings provide useful implications for online health communities that have implemented or are planning to implement digital gifting to stimulate user engagement.

Uncovering the Neural Processes of Privacy: A Neurally Informed Behavioral Intervention to Protect Information Privacy (p. 727)
Crystal Reeck, Xue Guo, Angelika Dimoka, Paul A. Pavlou

People are increasingly aware that their information is being tracked online. Although people generally self-report privacy to be important to them, in practice they often disclose far more private information than their self-reported privacy preferences. This "privacy paradox" could be better understood by uncovering the neural processes underlying the privacy calculus: weighing the risks against the benefits of disclosure. We assess the neural processes shaping privacy tradeoffs to characterize the neural mechanisms underlying privacy tradeoffs to design behavioral interventions that help people make better decisions that align with their privacy preferences. In Study 1, we used functional MRI (fMRI) to identify the neural correlates of the privacy calculus. In Study 2, we leveraged brain insights to design and test a neurally informed behavioral intervention to help people protect their privacy. Our results show that altering the timing when information is presented precisely at the time of decision (specifically within a second) directs attention to privacy risks versus benefits, therefore discouraging participants from disclosing their private information. Identifying the neural processes of privacy helps elucidate the privacy calculus and sheds light on the privacy paradox and guides the design of neurally informed behavioral interventions to help people protect their privacy.

The Impact of Online Q&As on Product Sales: The Case of Amazon Answer (p. 747)
Warut Khern-am-nuai, Hossein Ghasemkhani, Dandan Qiao, Karthik Kannan

This study uses observational data from two online retail sites to examine the effect of questions and answers on sales of experience goods. Particularly, we leverage the naturally occurring experiment where the Q&A capabilities are available on only one platform. Interestingly, we discover that answers, especially the depth of answers, positively affect sales. Additionally, the fraction of questions with at least one answer positively and significantly affects product sales. Our additional textual content analyses unveil that fit- and quality-oriented questions have different effects on sales, as do positive and negative answers. Insights from this work can help platform managers develop Q&A ecosystems and content management policies.

When the Clock Strikes: A Multimethod Investigation of On-the-Hour Effects in Online Learning (p. 766)
Ni Huang, Lingli Wang, Yili Hong, Lihui Lin, Xunhua Guo, Guoqing Chen

Online learners often experience a lack of sustained motivation given the self-paced nature of online learning, resulting in inefficiency and a high dropout rate. It is important to explore options that help users optimize their learning behavior and improve their learning performance. Using a multimethod approach, we show that (a) starting learning sessions at on-the-hour time points activates users' implemental mindset, which supports them in building greater learning persistence and achieving better learning performance, and (b) social presence significantly attenuates the effects of on-the-hour time points in online learning. Based on our findings, we suggest that both learners and instructors on online learning platforms can leverage common temporal cues, such as on-the-hour time points, to schedule learning activities in order to motivate online learners, enhance their learning persistence, and improve their learning performance. Additionally, online learning platforms can also adopt designs that facilitate virtual connections among geographically separated users to enhance their learning productivity.

Seek and Ye Shall Find: An Empirical Examination of the Effects of Seeking Real-Time Feedback on Employee Performance Evaluations (p. 783)
Michael Rivera, Cheng Jiang, Subodha Kumar

This research delves into the impact of real-time feedback applications on the engagement of employees with performance evaluation programs. The study focuses on feedback-seeking behavior and rating, which have been neglected in previous literature. The research analyzes nearly 11,000 feedback instances from employees at four major organizations to examine how seeking and rating feedback affects in-kind evaluations. The results indicate that seeking feedback can enhance constructive communication among colleagues. Feedback seekers receive lower feedback scores but are more likely to receive longer and more subjective comments. Feedback givers who choose to remain anonymous provide shorter comments or no comments to feedback seekers. The study also reveals that feedback seekers prioritize longer comments over high feedback scores

when rating feedback. The study recommends that managers and organizations encourage feedback-seeking behavior to promote a culture of constructive feedback. When implementing feedback applications, it is important to prioritize creating an environment that fosters constructive feedback.

Mobile Payment Adoption: An Empirical Investigation of Alipay (p. 807)
Yuqian Xu, Anindya Ghose, Binqing Xiao

Utilizing a unique data set from a leading bank in Asia that records credit card transactions of its customers before and after the launch of Alipay mobile payment, the largest mobile payment platform in the world, this study aims to understand the impact of mobile payment adoption on bank customer credit card activities. To do so, we employ the difference-in-differences method coupled with matching to estimate the effects. We find that mobile payment adoption not only increases customer credit card activities at the focal bank through both offline and online channels but also enhances customer loyalty to the bank by reducing churn. Specifically, the total credit card transaction amount and frequency of our focal bank increased by 9.4% and 10.7%, respectively. Next, we show that mobile payment acts as a substitute for physical card payment in the offline channel, supporting the key underlying mechanism of the reduced transaction cost. However, a certain complementary effect exists between personal computer and mobile payments, likely driven by the coadoption of the two. Finally, we provide empirical evidence on conditions that facilitate the use of mobile payments, following the unified theory of acceptance and use of technology.

Attending to Customer Attention: A Novel Deep Learning Method for Leveraging Multimodal Online Reviews to Enhance Sales Prediction (p. 829)
Gang Chen, Lihua Huang, Shuaiyong Xiao, Chenghong Zhang, Huimin Zhao

Review helpfulness has been measured commonly relying on quantitative indicators at the review level. Helpful reviews qualified by such simple indicators, however, may not necessarily yield accurate sales predictions, owing to the ever-evolving review information quality, customer demand, and product attributes. Positing that reviews with higher customer attention should be more influential to customers' purchase intention and product sales, we propose to leverage customer attention to better realize the potential of multimodal reviews for sales prediction. We conceptualize customer attention at the holistic review set, review subset, individual review, and review element levels, respectively, and induce four indicators of customer attention, that is, timeliness, semantic diversity, voting-awareness, and varying multimodal interaction. We then propose a novel deep learning method, which incorporates these customer attention indicators using neural network attention mechanisms specifically designed for multimodal-review-based sales prediction. Empirical evaluation based on a large data set in a case study predicting hotel sales (specifically, monthly occupancy rate) shows that, in terms of both prediction performance and representation learning performance, our proposed method outperformed benchmarked state-of-the-art deep learning methods. As multimodal reviews become increasingly prevalent, this method serves as a tool for adequately leveraging such multimodal data to support business decision making.

Should an Ad Agency Offer Geoconquesting or Protection from It? (p. 850)
Manmohan Aseri, Amit Mehra, Vijay Mookerjee, Hong Xu

This study examines the interaction between top-of-funnel advertising (e.g., search or display advertising) and bottom-of-funnel advertising (e.g., using a mobile application on a smart phone). We are particularly interested in the phenomenon of *geoconquesting*: the bottom-of-funnel advertising efforts of a firm to poach (or lure away) customers that have come to a competing firm's physical store as a result of top-of-funnel advertising efforts by the firm. Geoconquesting efforts by a competing firm should reduce a focal firm's incentive to invest in top-of-funnel efforts. Thus, a key challenge for an agent like Google that provides both top-of-funnel and bottom-of-funnel advertising services, is to balance the inherent conflict between the two in order to maximize the total revenue collected from the two forms of advertising. We develop a game-theoretic model to study the this phenomenon. A key result is that sometimes the agent benefits from not offering geoconquesting, but instead promises, after collecting a fee, to protect the advertisers from poaching on each other's search traffic. Interestingly, such a protection service becomes more lucrative for the agent when a cheaper outside option for geoconquesting is available to the advertisers.

Smart Markets for Real-Time Allocation of Multiproduct Resources: The Case of Shared Electric Vehicles (p. 871)
Micha Kahlen, Karsten Schroer, Wolfgang Ketter, Alok Gupta

Motivated by the deep transformation of the transportation sector toward electric and shared mobility, this research develops a decision support system that enables real-time allocation of shared electric vehicles (SEVs) to either the rental market or aggregated as a

virtual power plant to the electricity market. The multipurposing of SEVs beyond the traditional scope of mobility services can boost utilization and profitability for fleet operators while also facilitating the integration of variable rate renewable energy sources. This SEV setting embodies the problem of real-time multiproduct resource allocation via smart markets. We develop an approach that leverages highly digitalized real-time markets and intelligent decision making to enable dynamic multiproduct resource allocation. The tool continuously evaluates market attractiveness and strategically places iterative bids on the resource owner's behalf until all resources have been committed for a specific period. Our key contribution is to provide a blueprint for similar multi-product resource allocation settings, and demonstrating its efficacy in the domain of SEV fleets by developing tailored analytics and machine learning-based solutions.

Explainable Deep Learning for False Information Identification: An Argumentation Theory Approach (p. 890)
Kyuhan Lee, Sudha Ram

To combat false information, social media sites have heavily relied on content moderation, mostly performed by human workers. However, human content moderation entails multiple problems, including huge labor costs, ineffectiveness, and ethical issues. To overcome these concerns, social media companies are aggressively investing in the development of artificial intelligence-powered false information detection systems. Extant efforts, however, have failed to understand the nature of human argumentation, delegating the process of making inferences of the truth to the black box of neural networks. They fail to attend to important aspects of how humans make judgments on the veracity of an argument, creating important challenges. To this end, based on Toulmin's model of argumentation, we propose a computational framework that helps machine learning for false information identification understand the connection between a claim (whose veracity needs to be verified) and evidence (which contains information to support or refute the claim). The two experiments for testing model performance and explainability reveal that our framework shows stronger performance and better explainability, outperforming cutting-edge machine learning methods and presenting positive effects on human task performance, trust in algorithms, and confidence in decision making. Our results shed new light on the growing field of automated false information identification.