AI in Marketing
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Week 9
Lecture-45 Role of AI in Advertising-II

Welcome to this NPTEL online certification course on Artificial Intelligence and Marketing. Now we will talk about module 45. So, as you can see from this slide, we started talking about the role of AI in advertising. And in module 44, we started this discussion, and the same discussion will continue in module 45 also. So, this is part 2 of the topic of role of AI in advertising and we are in module 45. Now these are the various things that we will talk about in this module.

Starting with multi-armed bandits and its roles and its role in house ads. The obstacle we face while using AI for advertising. Advertising biases while using AI algorithms. Categories of advertising biases and steps to avoid such biases in advertising.

So now let us look at what is this multi-armed bandit in advertising. In probability theory and machine learning, the multi-armed bandit problem is a problem in which fixed limited set of resources must be allocated between competing. That is alternative choices in a way that maximizes their expected gains when each choice properties are only partially known at the time of allocation and may become better understood as time passes or by allocating resources to the choice. This is the classical reinforcement learning problem that exemplifies the exploration exploitation trade-off dilemma. The name came, the name comes from imagining a gambler at a row of slots machine who has to decide which machines to play, how many times to play each machine and in which order to play them and whether to continue with the current machine or try a different machine.

The crucial trade-off the gambler faces at each trial is between exploitation of the machine that has the highest expected payoff and exploration to get more information about the expected payoff of the other machines. In machine learning, the exploration versus exploitation trade-off applies to learning algorithms that want to acquire new knowledge and maximize their rewards at the same time. What are referred to as reinforcement learning problem? In this setting, regret is defined as you might expect. A decrease in reward due to executing the learning algorithm instead of behaving optimally from the very beginning. Algorithms that have optimized for exploration tend to incur more regret.

This is better than A-B testing. A-B testing is a purely exploratory approach. Sales contacts are randomly assigned to each variant with equal probability in an A-B test experiment. The overall payoff achievable equals the average payoff of all the variants and must be lower than that of the variant. A typical A-B testing tends to acquire hundreds of thousands of contacts to reach appropriate statistical power.

Using a fixed sized random allocation algorithm to conduct this type of experiment can lead to significant amount of loss in overall payout. That is A-B test can have very high regrets. Multi-armed banded algorithm can be thought of as alternative to A-B testing that balance exploration and exploitation during the learning process. A multi-armed banded solution uses existing results from the experiment to allocate more contacts to variants that are performing well while allocating less traffic to variants that are underperforming. In theory, multi-armed banded algorithms could produce higher overall payoff.

So that is one and it also leads to reduced regrets while still allowing one to gather data on how users interact with different variations of the campaign. Now how to use multi-armed bandits for house ads? House ads or internal links correspond to promotional information displayed on the retailer's website to highlight some specific product or category of products. House ads are an important component of the web design for most online retailers not only because they can have a direct impact on short-term sales but also because they can provide more consistent product offerings that positively impacts consumer satisfaction. In recent years, many websites have started to use different recommendation systems to decide the content to display to their visitors. Multi-armed banded can address the problem of selecting a collection of house ads to exhibit at the homepage of a large retailer's transactional website to move customers forward in their purchase funnel.

The problem is dynamic in nature for several reasons. For example, the set of available ads and the context in which those ads are displayed change over time. Furthermore, the effectiveness of a given ad can change over time because its attractiveness veers out. A common practice in industry to deal with this dynamic problem is to decompose it into two stages. Stage 1 that is the initial stage, the decision maker evaluates the potential effectiveness of each ad by using randomized experimentation.

And then, in the second stage, marketers choose to display a combination of the best ads. However, it has been shown that this practice might be suboptimal because it does not explicitly consider the opportunity cost of the learning phase. A more efficient approach to deal with this problem is treating it as a multi-armed banded problem to define a strategy that minimizes the total expected. In a MAB framework, one must select a sequence of actions. So, the first thing is to do is to select a sequence of action, maximize a cumulative reward with an imperfect knowledge of the performance of each action.

By adopting this approach, you can explicitly address the well-known exploration-exploitation trade-off where we are simultaneously interested in learning what types of ads perform better and maximize the performance of the website by showing the best ads. Now, what are the obstacles while using AI in advertising? Some potential obstacles that need to be kept in mind while using or adopting AI for advertising. The first obstacle is weak IT infrastructure. To implement a robust AI strategy in advertising processes, we will need a strong IT infrastructure that can handle it. Before doing anything else, it is crucial to speak to the IT department to determine what can be taken on and what task needs more preparation time.

The second obstacle can be too little high-quality data. With the influx of data, it can be difficult to manage both the quality and insights derived from the information. Convergence and interactions happen across channels in both online and offline environments. The vast amounts of data can make it harder to plan for longer-term initiatives. Additionally, navigating the data and ensuring the collected information stays current can be a difficult thing.

The outposts and insights generated from AI can only be as useful as the data it is based on. So, we can have all the data that we need. But it is useless if it is low quality. Even if the data is high quality and if we do not have the tools available to decipher it, we cannot create actionable insights for the team. Ensure that the data you are retrieving is of the highest quality possible and invest in a tool that can help you understand from these various information sources.

Yet another obstacle of using AI in advertising is privacy and regulations. New regulations concerning user privacy can make ensuring your strategy is compliant feel overwhelming. Regulations differ across countries. For example, general data protection regulations, governing body of European Union or even across state lines. When we are using AI to connect with people, privacy concerns are found to arise.

We have to ensure that we are following the necessary privacy policies and regulations and consider cookies less targeting and consider cookie-less targeting for advertising efforts. The legal team should provide the necessary guidance before implementing the plan. Another obstacle while using AI in advertising is a user base not wanting to accept AI. While personalization can be helpful to many customers, many people still feel uncomfortable with it due to data privacy issues. So, this data privacy will always be.

So, this privacy issues will always be there with with the use of AI. We have to ease the audience into it if they are feeling hesitant. Balancing the right amount of personalization for consumers can be a struggle for many organizations. Many users think company go a

little too far with their personalization efforts. Companies should use personalization as a tool that focuses on making the customer experience better for the end user.

Now, the biggest problem is that the users they are thinking that the companies are little too far with their personalization efforts. And they should focus on making the customer experience better for the end users. Another problem is that of budget consideration. Today, investment in AI technology is a business imperative and can seem like a big line item. However, we should keep in mind that this investment can lead to decreased expenses and more efficiency in other areas not previously realized.

Therefore, having more reliable data can lead to making more efficient decisions which can decrease expenses in other areas. Another benefit that can lead to reduced expenses is due to more efficient utilization of a staff. For example, with AI comes automation. This process allows mundane tasks to be handled by machine while allowing the team to dedicate resources to high priority items. Another problem is that of skills gap.

As technology advances and threats become more sophisticated, fewer people are qualified to manage them. Often data scientists are required to decipher the data and managers are required to ensure that data remains relevant and clean. Getting buy-in, it can be difficult to demonstrate the value of AI to a company's stakeholder. KPIs like ROI and efficiency can be quantifiable by showing how AI improves customer experience is less obvious. Due to this, marketing teams will need to ensure they can attribute these qualitative gains to AI investments.

The next comes advertising bias. So that is yet another obstacle in the use of AI in advertising. So, advertisers really have insights into how algorithms work and how unconscious biases can be coded into them. So, the bigger problem is that they do not know how the algorithm works and how unconscious biases may be coded into them. Advertising bias that is coded into the technologies used to deploy campaigns can have a negative impact on performance and return on investments. Although bias can be a challenge for advertisers when dealing with AI, machine learning technologies can also help mitigate bias in campaign when deployed correctly.

So, machine learning technologies can be used to overcome the biases in biases that can be there with the use of AI. As the industry increasingly relies on AI to segment audiences and run campaigns, more decisions are being made by machines. Marketers using AI technology try to remain objective in their decisions. However, as the Federal Trade Commission noted, machine learning can result in biases and discrimination against marginalized groups. So that is a problem with this as noted by the Federal Trade Commission that machine learning can result in biases and discriminations against the marginalized groups.

Companies are forced to look into their own data sets to determine what is being collected. For example, analyzing which users click on ad is only a fraction of the intended audience. As the industry increasingly relies on AI to segment audience and run campaigns, more decisions are being made by machines. CMO often lacks insights into how these algorithms are working and what biases may be built into these into the models. Decisions are then sometimes made via unintentional signals like age, race or gender, which introduces biases to the campaign.

For CMOs looking to scale their marketing efforts, addressing bias is an important concern. An added problem with advertising biases is that marketers are often unaware of the impact on consumers, advertisers and campaigns and their brands. So, the biggest problem is that with these biases that marketers, they are unaware of how it is going to affect the consumers, the advertising campaigns and the brands. Now let us look at the categories of bias in advertising.

So, the first is unconscious bias. Also known as implicit bias, that is when people unconsciously attribute stereotypes to certain groups of people. People are often completely unaware of these biases, but they can have a significant effect on their decision making and behaviors. These biases can be especially challenging since people are not consciously aware of them. There are three types of unconscious biases that will be discussed in the next slide. So, the first of unconscious bias is the racial bias.

Racial bias includes assumptions people have about individuals belonging to different ethnicities and races. These unconscious biases can have implications for how AI algorithms and machine learning tools are developed. One study by science noted that algorithms were less likely to refer black people than white people to healthcare programs, even if both demographics are equally sick. Another type of unconscious bias is gender bias. So, gender bias affects the commercials and ads consumers interact with and can impact decisions made under the surface by advertising technologies and algorithms.

Between 1980 and 2010 that is about 30 years time women were depicted at work only 4 percent of the time. Even as recently as 2019 the the Geena Davis Institute of Gender in Media noted that men were twice as likely to be depicted in the workplace. These biases can lead to harmful representations and make the audience feel disconnected from the brand. So, this is the impact of these kind of biases on the audience that they are harmful representation, and the audience feels that they are disconnected from the brand.

The third is ageism. According to a recent study survey participants felt that advertisers displaced those age 55 plus in an unfair light. The consumers noted that ads tend to show a mental decline, weakness or a lack of understanding for technology. However, many people in this demographic would be strong target consumers for brands. Its companies

could learn how to better connect with them. Companies that employ stereotypes in their advertising will push potential prospects away from doing business with them.

So that is the problem. When they have employed these stereotypes so they will push away the potential prospects from them. Then comes statistical bias. Statistical bias showcases data with misleading results due to an inaccurate representation. For example, if marketers want to gain insight into car owners but only gather information on those who drive luxury cars then they will have an incomplete data set because they are using data only from the people who drive luxury cars. If statistical bias occurs the information will not be representative of the demographics at large and will cause inaccurate and inefficient decisions to be made.

So, when the information is not representative then obviously the outcome is also not representative. In an article from Association of National Advertisers it is argued that the data which marketers rely on is often incomplete and biased. Data is collected in a variety of manners, often missing information which can lead to decisions based on incomplete findings. Algorithms may also include samples of the data when representing information. Favoring specific population over others due to constraints in collecting data.

Yet another type of bias is the cognitive bias. Cognitive biases are errors of judgments that are caused by unconscious psychological mechanisms. So, there are errors of judgments that are caused by unconscious psychological mechanism. Many cognitive biases are caused by mental shortcuts that the brain uses to make quick decisions. We will discuss two types of cognitive biases. The first type of cognitive bias is the confirmation bias.

Confirmation bias is one of the most well-known cognitive biases and is when people focus on information that conforms their pre-existing beliefs while ignoring any information that goes against them. In an experiment, study participants were given a series of questions. They were allowed to change their answer if they caught mistakes in their thinking. Only 15% of the participants changed their answers. Later they were shown their answers again alongside someone else's.

However, these were mislabeled. About 50% of the participants realized the switch. 60% of those who did not realize the change were more critical of their answers than they had been before. The second type of cognitive bias is exposure bias. People are also more likely to like a product the more often they are exposed to it. In the book named The Like Switch, a former FBI agent notes that proximity matters when trying to create rapport with another person.

Exposure can influence how people perceive a person, product or service. So, this is the bias that we are talking about exposure bias. So, as he said proximity matters when trying

to create rapport with another person. Yet another bias is systemic bias also known as institutional bias. It includes organizational policies, laws or practices that cause discriminatory effects against particular social groups.

These biases occur in almost every type of institutions. Often when people think about bias in advertising, it is the type of bias described previously that comes to mind. But there is one more bias that needs to be considered when running an advertising campaign using data and algorithms and that is technological bias. Technological bias happens when human biases are often unknowingly encoded into technology. So all these biases, human biases, they go into the technology which then has the capacity to upscale the bias at a systemic level and potentially amplify the bias of a small group of people. As the advertising industry increasingly relies on platforms that automatically segment and select audiences, deliver offers, optimize creativity and more critical decisions are made by machines, making it absolutely critical that we identify and mitigate biases in the air-tech systems that power our entire ecosystem.

Identify and mitigate. Now how to steps to avoid biases in advertising? The first is to gain a better understanding of the technology employed. The first step is to develop an understanding of how unintended bias enters the machine learning and AI model used to inform advertising strategies. So, the first step is to develop an understanding of how these unintended biases they enter the machine learning and AI module. So, marketers need to fully understand the tools that they use and how biases can affect their strategy, audiences and brands. The second is to balance both advantaged and disadvantaged groups.

Research shows that biases often result in both advantaged and disadvantaged groups. Balancing these groups with the help of available solutions that is that that will be outlined below could help optimize the campaign to create engagement across a broader subset of the audience resulting in more convergence. Go beyond typical campaign reporting. If outcomes are unquestioned potential biases will be unchallenged and continue to impact the brand and consumers. To understand why certain subgroups are performing better or not they need to be more deeply analyzed to discover hidden biases.

Typical campaign reporting likely will not consider the possibility of machine-enabled biases. The fourth is to initiate mitigation strategies. Once any bias are discovered it is time to apply methodologies that will balance them. This can be applied when training the machine learning models for conducting a post for processing analysis scenario after the campaign has run in order to inform the future approaches. So to conclude in this module we have first discussed about multi-armed bandit and stole in-house ads.

Then we have discussed about the obstacle we face while using AI for advertising. We have also discussed about advertising biases while using AI algorithms. We then studied

the various categories of advertising biases and finally we have also learned about some steps to avoid such biases in advertising. And these are the 9 sources from which material for this module was taken. Thank you.