

Brij Disa Centre for Data Science & Artificial Intelligence



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Articles :

1 India's Path to leveraging Artificial Intelligence

Author :

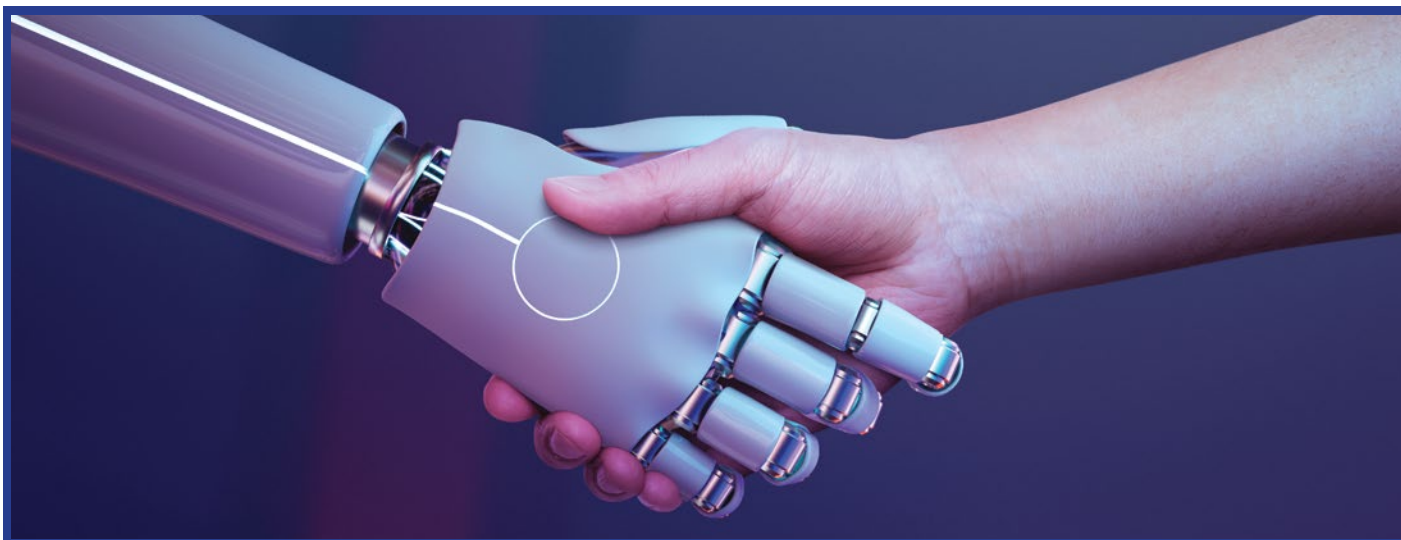


Debjit Ghatak

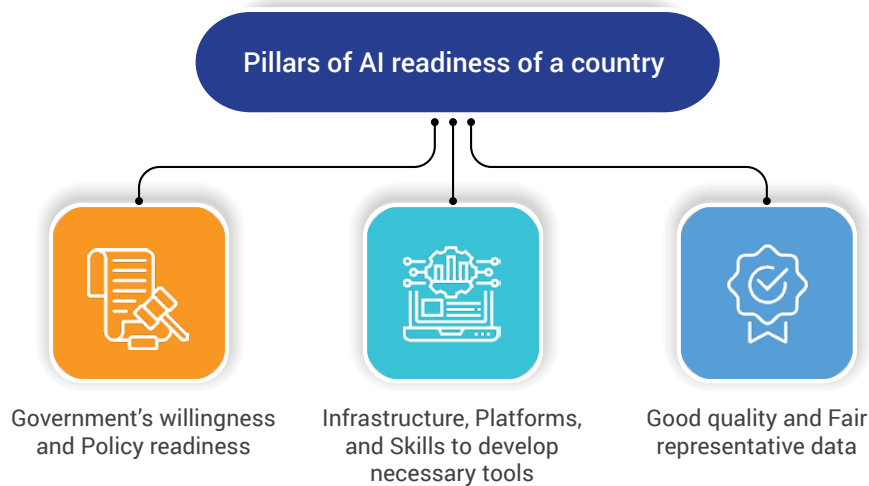
Center Head for CDSA

Along with heading CDSA, Debjit brings extensive experience in Digital Strategy Consulting in the Telecommunication domain

As we stand at the cusp of the Artificial Intelligence (AI) era, it is worthwhile investigating what would be the key enablers in a country's AI journey and why every sector shall need to navigate a unique path and rely on a different set of growth levers. Before addressing this, evaluating the readiness for AI is essential. Additionally, is readiness enough to spur growth or something more is needed to operationalize AI for wider adoption. A developing, diverse, and populous country with concentrated pockets of development would generate complex datasets that would require careful analysis to generate unbiased and balanced insights. A 'Responsible' AI growth engine shall be essential.



Organizations around the world stand at Big Data 1.0, gathering, organizing, and analyzing large data sets at scale to augment their current operations. However, leading organizations that had invested in ramping up their data and digital capabilities over the last decade have now begun to reap benefits in the form of better understanding of their customers, suppliers, and businesses. In the case of some organizations (like Google, Microsoft, Amazon), the insights through continuous iterations and a vast complementary ecosystem are building up a significant advantage. Yet, Artificial Intelligence (AI) is very different from the technologies of the past and offers asymmetric advantages to native digital organizations that embrace it. With the world around focusing on researching AI, new techniques, and algorithms around it, the possibilities are endless.



The lowering of costs of smartphones and data has enabled the growth of broadband in India. With over 800 million broadband users and the lowest data rates, the data accessibility problem is being well addressed. Within a decade, there has been a monumental overhaul in the digitization of India and its governance. The digitization push across strategic areas and beyond, such as Governance, Public Distribution System, Agriculture, Health, Taxation, Payments, and others, is generating valuable data. It has set the stage for the industry to leverage precious data to draw insights and derive value.

The government's willingness to adopt AI is the cornerstone for the growth of AI. The Indian government has shown eagerness to adapt and has published an AI vision document. The National data sharing and accessibility policy have spurred the growth of national data repositories (such as CMIE, Indiatat, Opendata platform and data.gov). For data being gathered across India, consolidation, real-time updating, and better data quality is essential to create new opportunities. Additionally, India has signed multiple bilateral and multilateral pacts to advance AI adoption which is crucial for Indian enterprises to tap into global opportunities.

As we look beyond the vision, policy, and pacts, the availability of quality and representative data becomes key to operationalizing data. Each sector of the Indian economy is at a different stage of maturity and AI adoption cycle and their path to digitization, adoption of Big Data, and AI shall vary. For the larger population, BFSI (Banking and Financial Services, Insurance), Healthcare, Retail & Logistics, and Agriculture hold significant potential for AI-driven value creation. Some of these sectors have significant tailwinds in the form of conducive policies, tailored digital tools, and solutions as well as robust datasets, which would enable faster value unlocking.

India's BFSI sector has come of age with a strong policy framework, RBI oversight, and a thriving ecosystem of financial organizations and startups. This has brought financial services to large parts of the Indian population. The sector has been at the forefront of innovation and the adoption of digital technologies. Digital payments have seen phenomenal growth post demonetization. With one of the lowest transaction costs in the world across services, the sector is striving towards a better customer experience, higher security, and greater transparency.

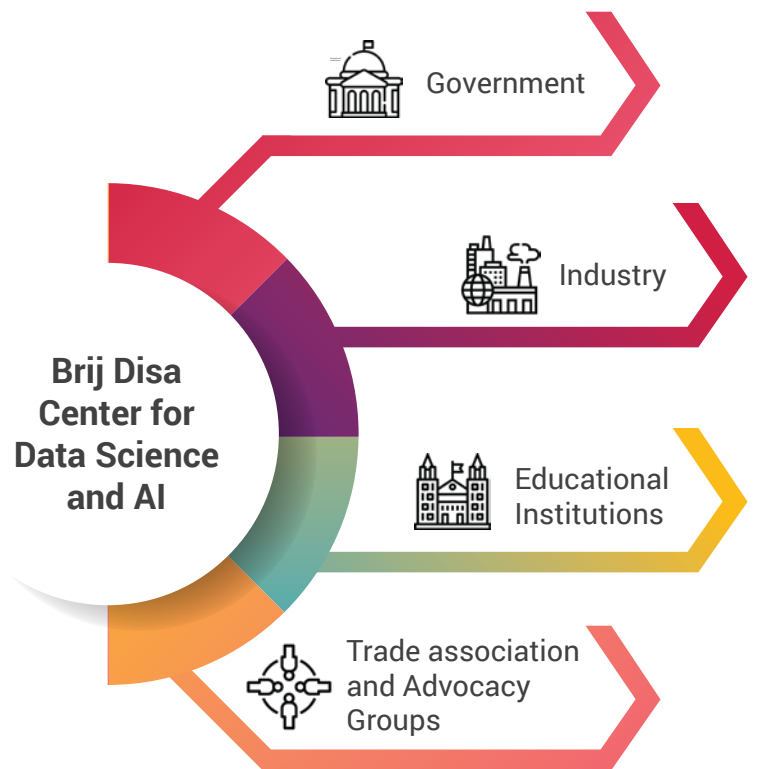
In a consumer economy, logistics and retail sectors are major drivers for growth. Current infrastructure is overstretched, costs are double that of developed countries (14% vs 8%) and India has its unique set of challenges. However, it is amid revival with private investments, deregulation, privatization, the introduction of GST and a government-led infrastructure push, growth above 10+% is imminent. However, the quality of growth is still to be seen as the sector continues to be unorganized and has challenges in terms of basic infrastructure and scalability. There is immense potential and with the rise of e-commerce and a plethora of startups, the sector shall see a sustained digital overhaul.

Healthcare and Agriculture sectors hold enormous potential to better the quality of life of the larger population. Both sectors have a complex network of intertwined national and state policies, making comprehensive policy overhaul difficult. Price control mechanisms, a network of distribution systems, and oversight make these industries very complex to navigate and long-term investments risky.

The agriculture sector employs 50% of the population however accounting for just 18% of GDP. Digital tools and resources are bringing multiple services at the grassroots level to improve the produce and income of the farmers. However, while startups at the grass-root level are bringing about some benefit, streamlining of policy and availability of data would allow for free market dynamics to simplify and bring significant value across the supply chain. Similarly, healthcare is largely fragmented, and state-owned, with public infrastructure capacity and quality being well below global standards. While the flourishing of generics and the pharmaceutical industry has given India access to medicines, there is a long way to go.

With Data Science and AI adoption in India still in its nascency, collaboration across the government agencies, industries, educational institutions, and advocacy bodies is essential to supplement capabilities across the board. Brij Disa Centre for Data Science and Artificial Intelligence (CDSA) at the Indian Institute of Management Ahmedabad (IIMA) provides a common platform to faculty, scholars, and practitioners for conducting and disseminating cutting-edge research on data analytics and artificial intelligence that offers solutions applicable to business, governance, and policy. Besides generating action-oriented insights, CDSA is also responsible for the dissemination of the knowledge generated to a wider audience both within and outside the realm of the Institute. Seminars, workshops, and conferences are regular activities at the Centre, which are conducted to reach out to and engage with stakeholders.

The Centre aims to forge synergistic and collaborative relationships between scholars and practitioners in data-intensive organizations, besides undertaking case-based research to understand the current industry practice and develop case studies for classroom teaching. Furthermore, through its collaboration with the industry, CDSA takes up challenging consulting projects of considerable practical importance. These projects are targeted at providing an opportunity for students to participate in projects that aim at outcomes that can further benefit the organization and the business, at large.



2 Rise of Ecommerce Platforms as Digital Marketing Powerhouses

Author :

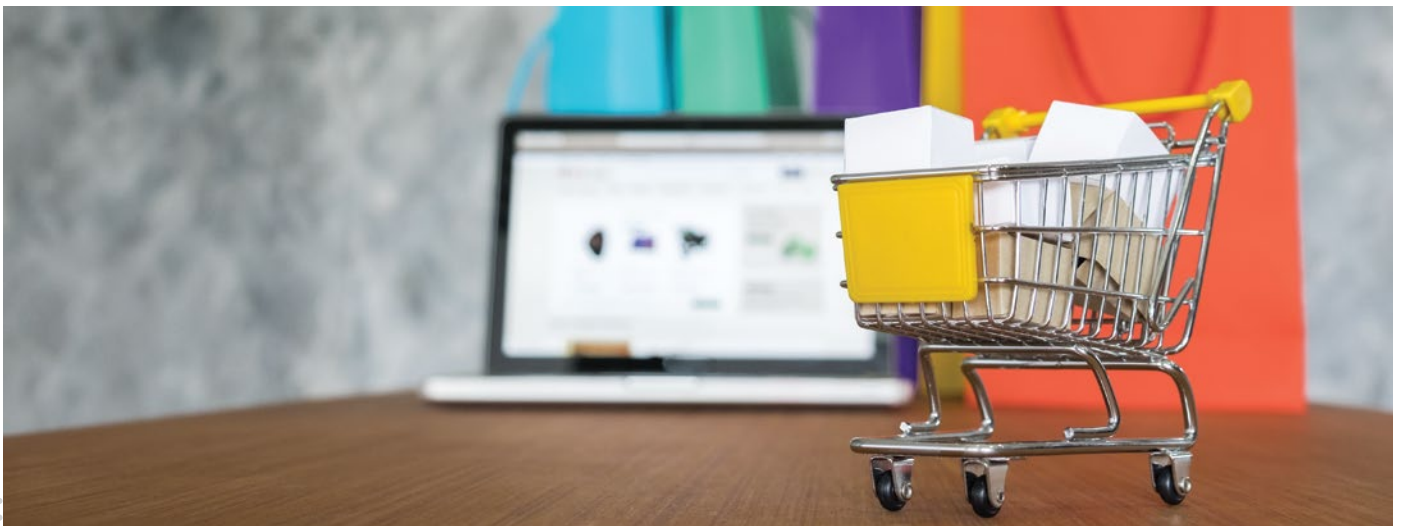


Mirza Rahim Baig

Analytics Lead at Zalando

He brings extensive experience in E-commerce and solving challenging business problems using the latest in Machine Learning and Artificial Intelligence. Author of "Data Science for Marketing Analytics" and "The Deep Learning Workshop", Rahim is also a visiting faculty at NMIMS teaching Advanced Machine Learning, Business Problem Solving courses

Major e-commerce players engage millions of users each day and serve them billions of impressions through an immersive experience. It has created significant digital real estate and thus a major playground for marketing. These changes have also accelerated the shift from mass campaigns to hyper-personalization. This prime marketing real estate is vied for by multiple interests - the platforms' internal interests (e.g. category merchandising teams) and external partners who now are major customers for the marketing services offered by major e-commerce platforms. The result is a hyper-competitive environment where many micro-decisions need to be made each day, hour, and second. The platform looks to balance interests between multiple categories of sellers as well as that of the customer and create value. The setup is ripe for AI-based solutions, however, when it comes to leveraging the complete potential, most players are only beginning to explore. How well a player leverages AI can now be that factor that determines the winner.



➤ E-commerce platforms rise as the new marketing playgrounds

2019 was an important year for the marketing world - digital ad spending surpassed print and TV for the first time in the United States (Washington Post, 2019). In 2022, digital advertising will exceed 60% of total global ad spend. While the impact of advertisement across some formats may be difficult to quantify, digital media offers a significant advantage over others. The growth in digital advertising spending over the last decade could be attributed to a variety of reasons: shift in customer behavior, better customer targeting, agility, accountability, engagement, and a better ROI.



Data is an asset today for most organizations, more so for those that rely primarily on profits from advertisements. Collecting comprehensive and reliable data is an uphill task and probing for insights to create value and a sustainable advantage further so. Over the last decade, as the browsing behavior of consumers shifted towards social media platforms and further towards e-commerce and multi-sided platforms, so has the value commanded by these platforms. Additionally, e-commerce platforms are leading the research and development in AI methods that help extract maximum value from the rich data. If the US is a leading indicator (Ad spending in the US equals that of the next 10 countries), the market consolidates around certain key players and a multi-sided platform such as Amazon commands a greater premium over its competitors. Amazon has recorded over 30% growth in ad revenue in one year and is the 3rd largest digital platform in the US, taking away advertisement market share from the likes of Google. In Europe, online Fashion leader Zalando enjoys a significant share of the total digital ad spend. Similarly, closer home in India, the Flipkart Ads platform emerges as a key player. Ecommerce players have become a one-stop-shop for marketing activity for organizations as they create solutions to market to users through digital as well as physical mediums.

➤ Everybody wants a piece of the pie

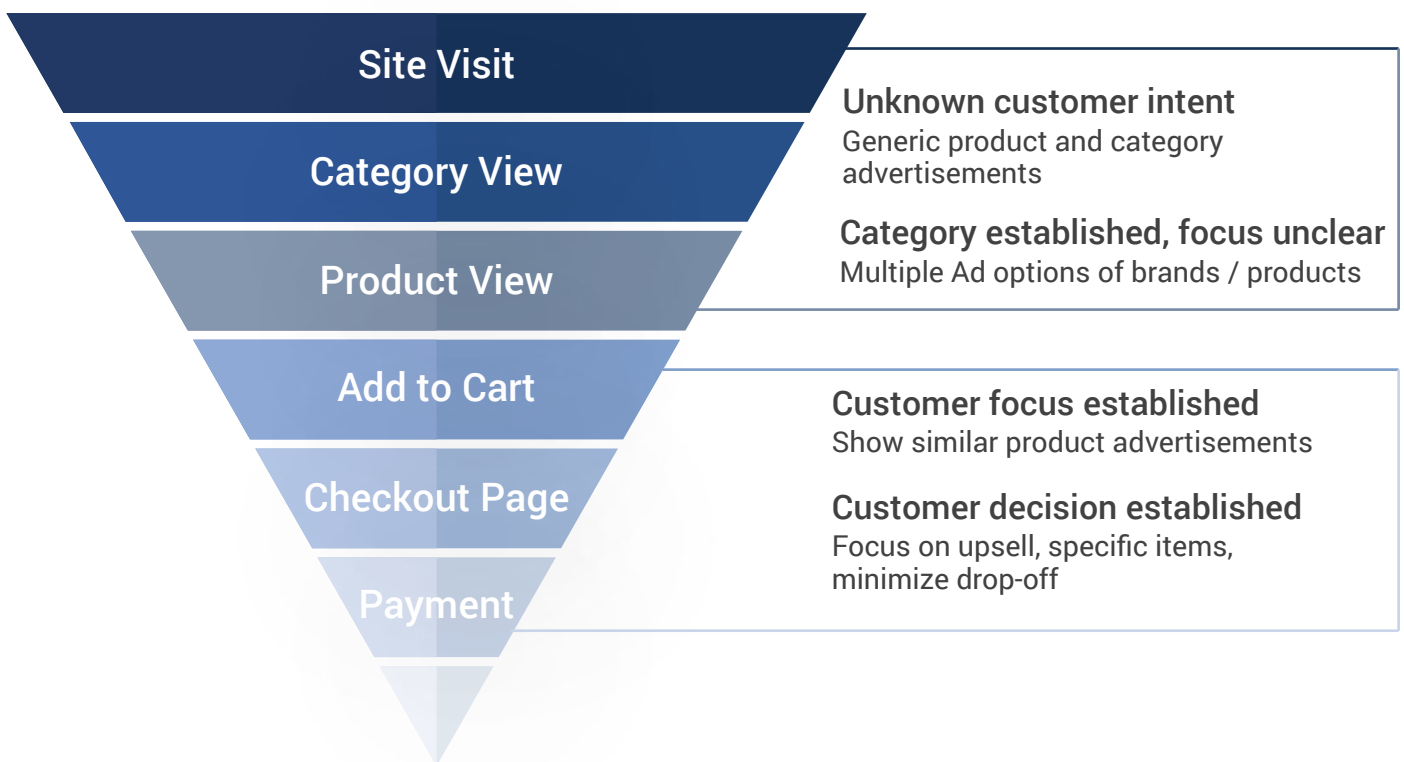
While Zalando SE aspires to be a “Starting Point for Fashion” in Europe, Amazon.com is striving to be “The Everything Store”. Such goals necessitate onboarding a wide range of brands and businesses as well as enabling them to perform on the platform. Shared success is an essential requirement of these brand partnerships. Both e-commerce platforms have their marketing solutions geared towards partners - Amazon has “Amazon Marketing Services”, while Zalando’s solution is called “Zalando Marketing Services”. Flipkart too has Product Listing Ads (PLA) and Product Contextual Ads (PCA) services for brand partners.

Through these marketing solutions, brands gain visibility on the platform at various stages of the customer journey. Customers usually start their journey on the platform at the homepage - unless they have arrived on the platform through a Push Notification, affiliate, or an alternate channel. At this stage, i.e., the top of the “funnel”, the platform has the least information about the customer intent. It is also more likely that the customer can be influenced by marketing campaigns. There is much more scope for the platform to advertise different sponsors and are not limited by the item category. Internal category campaigns also vie for visibility using their merchandising campaigns on the carousels.

When a customer searches, the premise of the search results is entirely different - the customer has expressed explicit interest. The search query could be a very specific one, specifying the brand and product category and even the specific model (the intent is extracted typically using Natural Language Processing

techniques like entity and aspect extraction, using Deep Learning Models). Generic and category-based searches allow platforms to display a wide array of promoted and organic choices. However, when the intent is specific, the advertisements need to follow. "Relevance" is paramount, and the advertisement focus shifts to comparable and competing products and brands.

When the customer visits the Product Details Page (PDP) of an item, they have expressed interest in a certain type of item - a specific price range, brand, style, and category of course. Any ad/recommendation must consider these if they are to be relevant. Even cross-selling results must promote items from complementary categories with high co-purchase propensities. A much deeper stage in the funnel i.e. when the user visits the cart before checkout also provides room for a recommendation. But platforms need to be extremely careful and balance the tradeoff between selling more and cart abandonment rates (drop-off from the cart) resulting from potential 'distractions' towards the end of the funnel.



Ecommerce Purchase Funnel

Contextualized and highly personalized campaigns across customer journeys are highly effective and preferred by brands who benefit from such 360-degree marketing across the customer journey - a win-win for the platform and the brands. L'Oréal SA reports that U.S. consumers go through up to 30 touchpoints before purchasing a skin-care product (in the research phase of the purchase cycle - ads, online searches, product reviews). Advertising on Amazon gives brands the possibility to engage customers at the likely moment of purchase, which is a strong differentiating factor for brands as compared to advertising on Google and Facebook. Results from the Zalando Partner Survey in 2020 (with 118 participating brands) show that 84% of digital leaders plan to run integrated campaigns along the customer journey.

Don't forget that platforms need to perform a balancing act. Among the several sponsored items, the customer needs to find enough relevant organic results too. Too many sponsored results, requiring scrolling down even for specific queries, leads to bounces (drop off) from the search results. While the incremental GMV uplift from more sponsored ads may offset the loss from bounces, the soft aspect of a customer's shopping experience is also important. Platforms are balancing their act by increasingly using tags like 'Best rated', 'Amazon choice', 'Budget' on organic results to maximize customer satisfaction.

Multi-sided e-commerce platforms thrive on creating value for both - partner businesses and customers. However, with platforms promoting home brands, partner businesses are facing stiff competition. While competition shall bring value to customers, a level platform is essential for all sellers. This involves balancing advertisements and search results fairly through a transparent bidding mechanism as well as a regular audit and publishing of results of the same.

➤ Slot allocation as a marketing micro-decision

Consider the case of a platform's prime property - a merchandising carousel on the homepage on the first fold (the first screen before a scroll). Such properties are usually allocated in timed slots, i.e. content changes every hour or sometimes much faster. They are highly contested as they give significant visibility leading to greater awareness, recall, and eventually conversions. Let us also limit ourselves to a particular customer segment - assuming that we are in the realm of (somewhat) personalized campaigns. The three dimensions to this allocation, therefore, are - the property itself (type and position), the customer segment, and the hour of the day. Note that this premise is a gross simplification as there could be many more dimensions depending on how complex, personalized, and adaptive the setup is (more on this in the next section). Slot allocation is a micro-marketing decision that is time-bound and micro-segmented across the customer base.

A single decision of this nature can potentially be made by a simple pre-defined criterion based on the purpose of that slot for the time like they usually are. For instance, a carousel on the home page can be reserved for internal (product) categories for merchandising purposes. The measure for merchandising campaigns' attractiveness/performance usually is the Click Through Rate (CTR) of the property clicks of the property/impressions. For such merchandising slots, a simple decision rule could be: "choose the campaign with the highest expected Click Through Rate". Note that a higher CTR does not necessarily translate to higher sales or Gross Merchandise Value (GMV) - lower priced items can attract higher clicks initially but then sell fewer units (quality issues, poor ratings, low brand value, etc.). A carousel could auto-choose a brand and advertisement based on the highest expected or based on Expected Conversion (units/clicks) to sell slow-moving stock.

Arriving at the expected CTR or GMV for a campaign is a science in itself. These estimates are often based on historical data (performance of similar campaigns in the past) or predictive models (ML models that make predictions based on user insights and campaign characteristics, along with many other 'features'). Yet another approach could be "explore and exploit" - where each campaign is randomly shown to all customer segments for a short period to generate initial data and arrive at an expectation for each segment. This helps overcome the cold start problem. Machine Learning techniques like multi-armed bandits, or more recent advanced approaches using Reinforcement Learning perform extremely well at such tasks and are being used increasingly by platforms.

Sponsored ads have different objectives and therefore different mechanisms. Pay Per Click models - used by Google or Facebook ads - work well for e-commerce too. Though having evolved into extremely complex systems over the decades, these models can be simply thought of as auctions. Each advertiser makes a bid with a maximum amount of money they are willing to pay for an advertising spot. The platform then makes a choice based on the bid along with some (optional) performance or quality estimates. Quality estimates are typically derived from AI/ML models. For example, for search ads, quality/relevance is established by a detailed analysis of the search query text, extracting the facets and the intent, and matching it with the item attributes using Natural Language Processing employed in conjunction with AI techniques (primarily Deep Learning). These supporting estimates along with the bid are used to make the allocation.

Properties can have different utilities and objectives, but in each case, the micro-decisions could be simplified to the extent where a simple rule is sufficient. It is important to note that these individual decisions were "greedy"; in the sense that they seek to optimize for the immediate decision criterion (clicks/payment) - and they can afford to be so. However, aggregated over all the various dimensions (slots, customer segments, hour), such micro-decisions define the state of marketing campaigns for the platform

on a given day. Over several days these form the marketing strategy of the entire platform. It is therefore pertinent to examine how these individual decisions roll up to the overall platform. Even more essential is to identify ways to orchestrate these decisions in a manner aligned with the intended strategy and objectives of the platform.

➤ Managing a million marketing micro-decisions

On a major e-commerce platform with high traffic and thousands (all advertising properties considered) of possible slots to be filled every hour, the number of marketing micro-decisions required in a day goes into several hundred thousand or even millions. The problem evolves into a problem of global optimization with multiple objectives with the constraints being defined by the strategy and the technical implementation.

Consider the search experience, where sponsored items need to be ranked along with organic results. Search is a classic example of a multi-objective optimization problem that has spawned extensive research. For most searches, a higher CTR (searches with a higher result clicked / total searches) can easily be achieved by prioritizing lower-priced items. This may negatively impact the conversion rate, leading to fewer purchases. Another risk is that this surfaces lower quality items that may have higher return rates, leading to costs of reverse logistics. More importantly, consistently poor/irrelevant search results impact CLV (Customer Lifetime value) which is the 'North Star' KPI for many platforms. Additionally, regional utilization of the available stock to minimize shipping costs is a key metric to balance, along with the delivery speed promised to the user in the top results.

E-commerce platforms like Amazon, Zalando, and Flipkart employ a variety of dynamic campaigns that are hyper-personalized and adaptive. The campaigns rely on micro-targeting - segmenting the customer by various attributes (demographics and behavioral), their browsing and purchase history, brand affinities, price affinities, and time of the day. Therefore, there is a huge amount and variety of data to be considered and a high number of decisions to be made. Additionally, customers of these platforms' marketing services need transparency into the working of the approach and need assurance of fairness. Studying various platforms, we discover some common salient features and requirements of marketing campaigns for these platforms -

- ▶ Extremely high cardinality i.e. number of decisions per day
- ▶ High level of targeting/personalization, adaptive to customer actions
- ▶ Orchestrating the decisions (having different objectives) to achieve "global optimization" to attain the platform's objective
- ▶ Transparency and fairness for all stakeholders

These requirements call for much more sophisticated approaches using Machine Learning and Artificial Intelligence. Indeed, the primary promise of ML/AI models, and their core strength, is the automation of practically innumerable micro-decisions. The research teams at e-commerce giants have been at the forefront of research, contributing significantly to the tools and techniques for AI/ML-based automation. For instance, Amazon has been a leader in research around real-time, hyper-personalized recommendations and deploys state-of-the-art AI models for targeted ads. Amazon has even developed products like Amazon Personalize that lets clients create real-time personalized user experiences without any AI/ML expertise required. The research team at Zalando makes active contributions to the area of recommendations and has built Algorithmic Fashion Companion (AFC) to recommend items in real-time based on the latest user actions. These models work in tandem with other predictive models (powering inferences on customer attributes and preferences) and layers of logic (including automated rule-based systems) to shape the user experience on the platform. The models are highly adaptive and can consider qualitative as well as quantitative information, structured and unstructured data (even product reviews posted by the customers) with the help of highly flexible and powerful Deep Learning techniques. The click-stream data generated in the current visit can additionally be used to form the highly informative "feature vector" that the AI/ML model can consume for near real-time predictions, enabling these players to make the most of the rich and massive data the platforms collect.

For the brand partners, this is an attractive proposition. First, AI-based models have empirically shown to outperform human judgment significantly, improving campaign effectiveness by far. Additionally, partners seldom possess the technical expertise and certainly do not possess the rich data that e-commerce platforms generate for each customer. Evolved AI-based solutions require that the partners provide only some high-level inputs e.g., goals, budgets, Advertising Cost of Sale (ACoS), and let the algorithms take over. With recent advances in interpretable and explainable AI (X-AI), ML models can be audited for transparency and fairness. Detailed explanations of received visibility/ impressions and performance insights can be generated automatically which is another factor for the increasing adoption of such marketing services.

If the 2020 brand insights survey of 118 top brands conducted by Zalando is any indication, we can expect more and more players and partners to adopt this digital transformation. 90% of digital leaders plan to leverage more tech and digital expertise and a similar proportion expect an increased relevance of personalization and targeting. 39% of brands expected an increase in digital marketing share. Smart 360 degree targeting across touchpoints and customer journey, powered by AI will be the key differentiator. The future of marketing is intertwined with the future of AI as advances in AI will propel marketing effectiveness in this new world of marketing-driven by AI.



3 From Barter to Crypto: The evolution of money

Author :

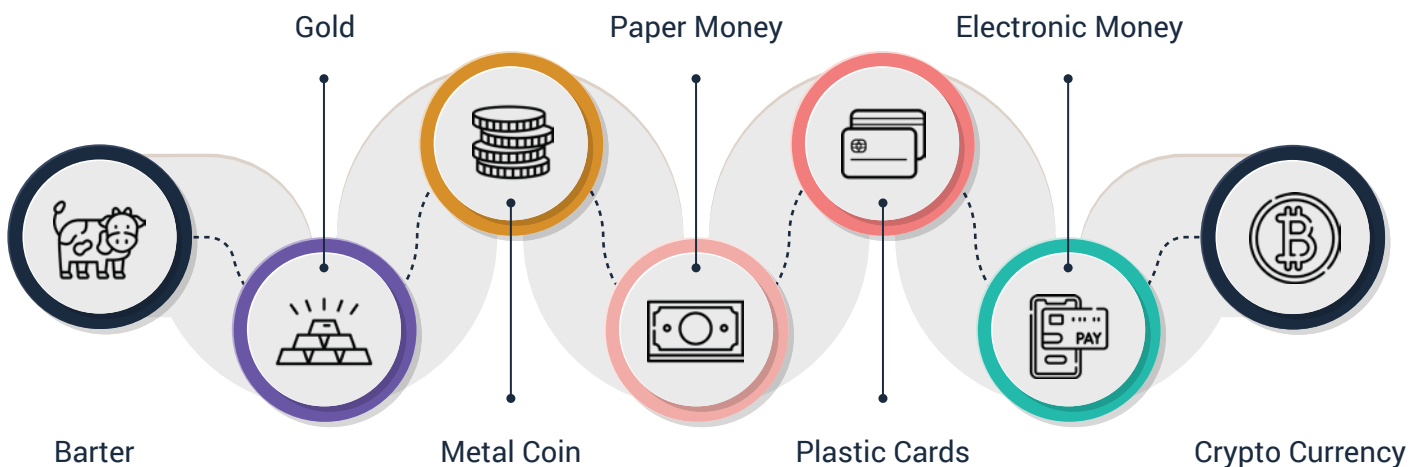


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Money is an enabler for any financial transaction and is regarded as a measure and store of value by people who consent to use it for their transactions. The earliest civilizations denominated money in livestock, food grains, spices, salt, among many other things. Goods were exchanged for these items, for instance, salt was used for commerce and trade in ancient Rome to an extent that historians often speculate, if the salaries to the soldiers in the Roman empire were also paid in salt [1]. Salt was a valuable commodity due to its common use as a preservative for food. In fact, a quick look at the etymology of the word 'salary' would suggest that it originates from 'sal', which is the Latin word for 'salt'. The monthly allowance received by the Roman army was called 'salarium' [2] that made it to the French word 'salaire' and eventually into the English language as the word 'salary'. While 'salary' in terms of 'salt' remains a matter of speculation, as there is no hard evidence apart from the claims of a few historians, what all of us very well know is that another commodity, i.e., gold, has definitely been used for paying salaries. Over the past many centuries, followed by the inefficiencies of barter for transactions, money has been a facilitator for conducting faster and efficient business. It has taken various physical forms, as coins and notes, and now also exists as electronically written records.



Money serves three important functions in an economy, namely, 1) a medium of exchange (a generally accepted and recognized medium for transaction of goods and services), 2) a store of value (a means to store value for the future from the current production or trade of goods and services) and 3) a unit of account (a means to make accounting of profits and losses from multiple different transactions of goods and services easier).

➤ Barter system

Almost all civilizations of the world at some point in time have relied on barter system, where people exchanged goods and services for other goods and services in return. Bartering has its own advantages; for example, it does not require any additional item (cash) for transactions, it helps people fulfil their needs by exchanging things that they already have and it is a mutually negotiated deal that does not involve any other party. Bartering remains a mode of transaction for the masses in societies whenever there is a monetary crisis, like the failure of the centralized banking system leading to money being in short supply or high devaluation because of hyperinflation. During the Great Depression of the 1930s, barter became a way of transaction for a larger number of people due to the short supply of money, and similarly as recently as in 2019 people relied on barter because of their currency devaluation during the Venezuelan crisis.

However, barter comes with its own inefficiencies and disadvantages. For example, one of the major problems is the 'double coincidence of wants,' i.e., a barter can occur only between two parties who have what the other wants. The second problem is the lack of a standardized and common unit of measure of value for items that would necessitate the exchange ratios for two goods to be negotiated for every transaction. The third is the problem of indivisibility, because of which an agreed ratio of 10 kgs of wheat with 5 chickens will not be realized as a transaction if the person with chickens is interested in only 5 kgs of wheat. Finally, bartering makes it difficult to store wealth, such as, it will be difficult for a person with perishable goods to store wealth for the future unless the person converts those items immediately into durable goods like livestock.

➤ Commodity money

The disadvantages of barter necessitated the introduction of money so that business and transactions can be done much more efficiently and at a much faster pace. The first currencies were in the form of commodities, like salt, shells and silk, and were referred to as commodity money. Grains, such as barley, were used for trade and commerce during the Mesopotamian civilization around 3000 BC [3]. A particular quantity of the commodity used for transactions formed a unit of money and units were exchanged based on the perception of the value of the item to be purchased. The use of commodity money can still be perceived as barter, but the acceptance of a common denomination by masses that represents a unit of account was a significant transition. However, these commodities were soon replaced with another form of commodity money, i.e., metal coins, which were primarily made of gold, silver, copper, tin or its alloys. The transition from commodities, like salt, shells and silk, to coins was important because of the inconvenience caused in their transport, storage and the possible perishing and spoilage. Metal coins were much more durable, easy to store and transport than other commodities. These metal coins that acted as denominations were often stamped with pictures and their exchange value was usually controlled by central governing or religious authorities.

➤ Fiat money

Convenience drove the evolution of paper money, when merchants in China as long as 1500 years ago issued promissory notes to avoid using a bulk of metal coins in large commercial transactions with wholesalers. In such cases, the metal coins were left by the merchants with a party trusted by the transactors and the merchant could issue a slip of paper in return of the material received from the wholesaler [4]. The actual coins could later be collected by the wholesaler from the party entrusted with keeping the coins. Similarly, small pieces of cloth having exchange rate mentioned on it against silver have been used as a means of trade in Europe as long as 1000 years ago. A rapid inflation of precious metals with the exploration of more and more reserves compelled a rethinking regarding how money works. In Europe, gold coins evolved into bank notes in the 17th century, when goldsmith bankers of London started giving out receipts as payable to the bearer of the document irrespective of who was the original depositor. This converted these bank notes into modern-day currencies as it could be exchanged for transactions with the goldsmith providing the security [5]. Of course, the goldsmith bankers also realized that they could issue a greater value of bank notes than the physical value of their reserves as not all the notes would be redeemed simultaneously.

A conversion of the large value receipts to multiple smaller fixed denomination receipts for ease of transaction essentially converted these bank notes to currencies with a written order by the goldsmith bankers to pay the amount to whoever was in the possession of the bank note. Interestingly, issuing bank notes that exceed the value of the precious metal in possession of the bankers leads to a counterparty risk that the bank may not be able to make the payment when presented with the note. The evolution of gold coins into bank notes led to the gold bullion standard in which gold coins no more circulated in the economy, rather an authority promises to give the bearer of the circulating currency an equivalent amount of gold bullion.

Historically, gold standard and silver standard have been used in monetary systems where the unit of account is based on a fixed quantity of gold or silver. In fact, gold was the basis for international monetary transactions until as late as 1970s, where some international currencies used gold as a backing, which determined the exchange rates. Most countries had legal minimum ratio of gold to currency notes that they need to maintain, and the international balance of payment differences were settled in gold. Post-World War I, several industrial countries abandoned the gold standard as the monetary system because of the constraints that it puts on the governments on using the supply of money as an instrument to manage recessions.



The necessity of being able to convert currency notes into gold whenever the bearer of the notes demands it, puts a strict restriction on the amount of currency notes that can be circulated. These issues led the countries to transition into fiat money where the currency is not backed by any commodity, like gold or silver, rather derives its value from the trust that people place on it, given that it has been issued by a central authority like a government institution of a country. Fiat money does not have any intrinsic value but can still be used as a medium of exchange because of the trust which people place in it and the value which they assign to it. While bank notes backed by bullion in the 17th century Europe was a form of representative money as it represented something of value stored elsewhere, fiat money is not even a form of representative money. It is a legal tender issued by a state or any other institution that serves as a medium of exchange. It does not derive its value from its form, as it is a non-valuable object, but through a measure of its demand and the extent to which it makes transactions easy.

Out of the various forms of money in history, some forms have worked better because of one or more of the following characteristics that make them useful, i.e., durability, transportability, divisibility, uniformity, scarcity, counterfeitability and acceptability [6]. Fiat money in paper form has often suffered on two characteristics, namely, durability and counterfeitability.

➤ Cryptocurrency

Bitcoin is one of the earliest cryptocurrencies (digital currency) and an alternative to a state or central bank-controlled fiat money. The question is, what is bitcoin similar to? It is not a commodity that can be put to use, it is not similar to a precious metal like gold, and nor it is similar to fiat money that is backed by a central authority. However, if one looks at the functions and characteristics of money that we highlighted earlier, one will observe that it does fulfil most of the criteria. Let us look at the characteristics mentioned earlier individually: a bitcoin is durable as it can live on the network for as long as the network exists; a bitcoin can easily be transported on the network through digital transactions; a bitcoin is highly divisible (up to eight decimal points); a bitcoin is uniform that means one bitcoin can be exchanged for the other; a bitcoin is scarce that means its supply is limited; and a bitcoin cannot be counterfeited easily. The only characteristic that if fulfilled will make it a widely acceptable currency is 'acceptability.' Given that a bitcoin satisfies the important characteristics of money, it serves the functions of money as well, i.e., a store of value, a medium of exchange and a unit of account. As we just saw, a currency derives its value not from the consumption or physical attributes, but through a measure of its demand and ability to stimulate trade and commerce. While it can be argued that, for some of the characteristics of money, bitcoin outperforms fiat currency, it is noteworthy that Bitcoin has faced its own challenges in recent years in terms of hacks and frauds.



Most of the discussions in the media about cryptocurrencies are about its volatility and valuation. The volatility for such currencies is often high as people speculate about the future use and valuation of digital currencies. This often raises a question as to how one would even do the valuation of such currencies. Let us assume that an individual is confident that in 10 years, the 21 million bitcoins in circulation will support the production of goods and services globally to the tune of 10 trillion USD annually. This can be thought of as a country that has an annual GDP of 10 trillion USD. Assuming that the amount of currency required for supporting a GDP of 10 trillion USD is 20% of GDP (i.e., 2 trillion USD), it would put the value of 21 million bitcoins at 2 trillion, or the value of a single bitcoin at 95,238 USD in 10 years. Assuming a time discounting rate of 5%, this amounts to a value of 58,471 USD today. Of course, the real picture is much more complex than this simple explanation. The speculation on the chances of bitcoins supporting a multi-trillion-dollar economy and the true size of the economy over the next few years leads to volatility in the currency. Any threat to the technology puts a question mark on this long-term assumption and pushes the value down, while any country or organization showing support or accepting bitcoins for transactions adds weight to the assumption and pushes the value up.

One is often curious about how cryptocurrencies are able to eliminate a centrally controlled authority and sustain on their own through decentralized nodes in a network. In a blockchain network, decentralization implies the shift in the power from a centralized authority to a dispersed network. One of the important aspects to achieve decentralization would be to ensure that the dispersed nodes in the network do not have the ability to collude to form a centralized authority that can corrupt the potency of the network. However, at the same time, some level of coordination and collaboration is expected among strangers based on an agreed set of rules that help in the sustainability of the network and create value through efficiency, equitability and privacy. Often referred to as peer-to-peer network, where the nodes interact or communicate with each other, the network facilitates democratization through distribution of power and evolves through consensus. We often outsource trust for a fee to a third-party that ensures that a contract between two parties is backed by the legal system to uphold one's rights in case of the violation of an agreement. The underpinnings of a decentralized system, like bitcoin, lies in the game-theoretic design of a network where trust is established through an incentive structure for a large group of nodes. For instance, the authenticity of a transaction made from one user of the network to another user of the network is authenticated by group of nodes through a consensus; the game-design ensures that the nodes establishing trust are incentivized and any collusion or attack from these nodes is expensive for them to an extent that it is almost infeasible in practice.

Finally, cryptocurrencies can be programmed through logic to create contracts that would get auto-executed when the pre-determined conditions between the buyer and the seller are met. This makes such digital currencies programmable and opens a massive space of smart contracts that eliminates intermediaries, thereby leading to savings in execution time and fees. Over the years several other cryptocurrencies apart from bitcoins, known as 'altcoins,' have spawned in the crypto-space. Most of these 'altcoins' have specific use-cases that span beyond digital money or decentralized finance; for instance, some of the most talked-about use-cases are in the areas of supply chain management, internet of things (IoT), asset digitization, data security and management, original content creation, etc.

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Research Projects

1 Can an AI Coach Help You Lose More Weight Than a Human Coach: Empirical Evidence From a Mobile Fitness Tracking App



Professor Anuj Kapoor

Artificial intelligence (AI) assisted tools are increasingly being used in health care contexts to provide advice and motivation. But whether AI can be a good or even better substitute for human involvement in these contexts is an open question. We provide empirical evidence to answer this question specifically in the context of fitness tracking mobile applications (apps). In addition to facilitating the tracking of activity and food intake, such apps provide advice and motivation in the form of targeted messages to their consumers, and this can be done through human coaches or an AI coach. An AI coach allows these apps to scale their offerings to a larger number of consumers, available on demand to consumers, and potentially more finely

targeted by leveraging vast amounts of data. On the other hand, human coaches might be better placed to show empathy, and consumers might also feel more accountable to humans. We compare human and AI coaches on their effectiveness in helping consumers achieve their weight-loss goals. Our empirical analysis is in the context of a large-scale mobile app that offers consumers different levels of subscription plans with human and AI coaches respectively, and specifically compares adopters of the two kinds of plans on their weight loss and goal achievement. We address the potential self-selection in plans by employing a matching-based approach. We find, for our sample of almost 65000 consumers that human-based plans do better than those in AI-based plans in helping them achieve their goals, but that this differs by consumer characteristics including age, gender and body mass index (BMI).

2 High-frequency trading: Measuring latency from big data



Professor Anirban Banerjee

Over the last decade, the Indian market has seen significant growth in algorithmic trading and more specifically, high-frequency trading (HFT) activity. During this period, we have witnessed a significant change in the trading landscape as presently close to half of the trading volume in the stock exchanges is contributed by algorithms. This rise has not always been smooth as there have been calls for regulations to restrict algorithmic trading activity due to the fear of probable market manipulation.

Latency is considered one of the most important market parameters for HFTs. Using a large novel dataset of order and trade level data from the NSE, we would like to inspect how the latency in the Indian market has changed and if that has caused any shift in the way HFTs operate. We would also like to observe how the different market quality parameters have evolved over this time.

3 Causes, Symptoms and Consequences of Sociocultural polarization



Professor Samrat Gupta

The Information and Communication Technology (ICT) provides users unparalleled access to information from around the globe. In spite of demographic differences, people can communicate, express and evolve their opinions on topics ranging from politics to culture. The wide-ranging information exchange on digital media can lead to two scenarios viz. formation of public sphere or formation of echo chambers. While the public sphere, which promotes greater diversity, is a well-researched domain, substantially less research has been conducted on echo chambers in relation to socio-cultural events. Despite the huge affirmative impact of socio-cultural events on society, the proliferation of controversies around them and

reinforcement through echo chambers is collectively having malefic effects on societies. Recent controversies around socio-cultural products such as movies, painting, books, cartoons, etc. resulted in serious outcomes. For example, Indian movie Padmavat brought polarization of public perception which further reinforced through echo chambers and escalated into widespread agitations. It led to mass destruction of property and human suffering during agitation. We believe this represents a mounting problem for society, one that is likely to intensify in the era of social media. Thus, understanding the causes, symptoms and consequences of socio-cultural polarization is critical and would be valuable for developing interventions to reduce unhealthy societal and organizational polarisations.

4 Employee Reviews - A Text Mining Perspective



Professor Adrija Majumdar

With the emergence of web 2.0, there is a deluge of online text. Technologies like online communities, social media, crowd funding platforms have further contributed to the volume of content. From the firm's perspective, understanding consumers' sentiment from the text is of supreme importance. The literature on online reviews has predominantly focused on ascertaining consumer sentiment of a firm's products and services. We extend this stream of research and focus on analyzing reviews that employees post regarding their organizations. The study will seek to identify different dimensions that employees highlight in their reviews and their association with overall job satisfaction. We further wish to understand if employees'

perception of the firms also impacts the firm's performance. The unstructured and noisy nature of the text data often poses significant challenges for organizations in leveraging them for decision making. We will employ text mining methods and techniques to quantitatively analyse the large dataset of employee reviews. The research will have implications for both theory and practice.

5 When A Machine Knows When You Are Happy (vs. Upset)



Professor Hyokjin Kwak

Artificial intelligence - the creation of human intelligence and beyond - has significantly altered the very nature of our modern business practice. The fascination towards non-living entities 'thinking and acting' with human intelligence is still as fresh and exciting as it was in 1956 - the year AI was coined. However, the latest trend on the role of AI has been gradually shifted from analytical brains (intelligence) to social brains (emotion). That is, this trend puts more emphasis on anthropomorphic AI (e.g., humanoid AI robots). In fact, this aspect of 'humanization (anthropomorphization)' is not new to the field of branding in the marketplace. Marketers strategically imbues nonhuman entities with humanlike emotions, intentions,

motivations, and characteristics. In general, prior research on anthropomorphism shows a positive effect of downstream consequences on consumer evaluations when the brand "interacts" with consumers. Hence, this research project attempts to further investigate how "emotion (or affective)" AI can help brand practitioners engage their customers more with their anthropomorphic brands. A machine should be more effective in communicating brand information with consumers when the machine knows how to interact with consumers' emotional state (e.g., through their face and body).





Upcoming Seminars :

Advances in AI for Social Cyber-Safety (January 19, 2022)

Abstract: The safety, integrity, and well-being of users, communities, and platforms on web and social media is a critical, yet challenging task. In this talk, I will describe the cybersafety-focused machine learning methods, leveraging behavior modeling, graph analytics, and deep learning, that my group has developed to efficiently detect malicious users and bad content online. While developing models that are highly accurate is important, it is also crucial to ensure that the systems are trustworthy. Thus, I will describe my group's work on quantifying the reliability of cybersafety models against smart adversaries that are popularly used in practice, such as those in Facebook.

Professor Srijan Kumar

Assistant Professor at the School of Computational Science and Engineering at Georgia Institute of Technology.

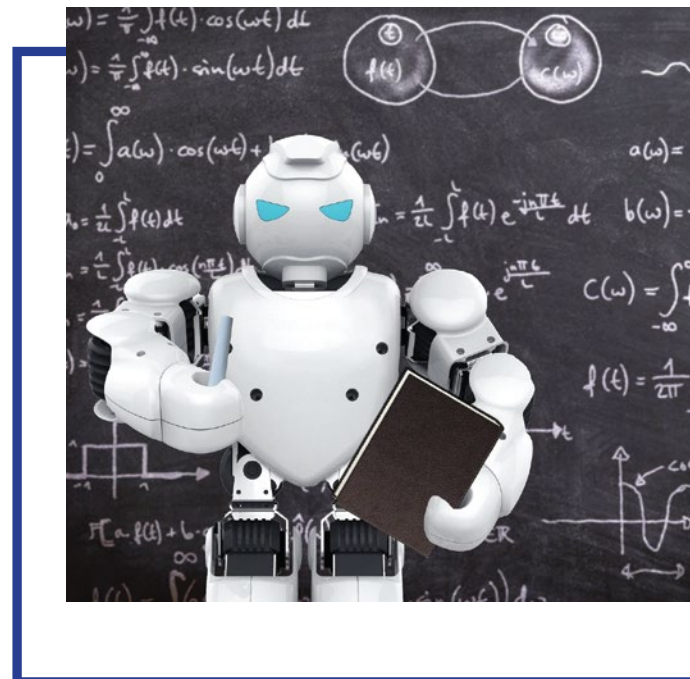


Can machines learn to see without humans teaching them? (January 27, 2022)

Abstract: In this talk, I will talk about self-supervised (or unsupervised) learning which tries to learn models without human supervision. I'll present a series of works on self-supervised learning in computer vision. These self-supervised models automatically learn features that can recognize objects, identify images, and surpass traditional machine learning methods that use human labeling. Self-supervised models can easily use billions of unlabeled images, and inspecting the models shows us that they can automatically discover objects.

Bio:

Ishan Misra is a Research Scientist at Meta (formerly Facebook) AI in New York. He works on computer vision and machine learning, with a focus on developing models that are flexible and learn without human supervision. He has published over 35 papers in top-tier computer vision and machine learning venues. Ishan got his PhD in Robotics from Carnegie Mellon University in 2018 where his thesis received the SCS Distinguished Dissertation Award (Runner Up).



Ishan Misra

Research Scientist, Facebook AI Research

Other planned seminar speakers: Praneeth Netrapalli (Google Research, February/March, 2022)

Conducted Seminars :

- » Programmatic High Impact Information Systems Research Using Data Science to address Grand Challenges (November, 2021)

Professor Sudha Ram

Anheuser-Busch Endowed Professor of MIS, Entrepreneurship & Innovation in the Eller College of Management at the University of Arizona

- » Data Science and AI for a better tomorrow (August, 2021)

Professor Suprateek Sarkar

Rolls-Royce Commonwealth Commerce Professor, University of Virginia

- » Relevance of Data Science and AI in Food Ordering and Delivery industry (August, 2021)

Dale Vaz

CTO Swiggy



About the Centre

The Brij Disa Centre for Data Science and Artificial Intelligence (CDSA) at the Indian Institute of Management Ahmedabad (IIMA) provides a common platform to faculty, scholars, and practitioners for conducting and disseminating cutting-edge research on data analytics and artificial intelligence that offers solutions applicable to business, governance, and policy.

Besides generating action-oriented insights, CDSA is also responsible for dissemination of the knowledge generated to a wider audience both within and outside the realm of the Institute. Seminars, workshops, and conferences are regular activities at the Centre, which are conducted to reach out to and engage with stakeholders.

The Centre aims to forge synergistic and collaborative relationships between scholars and practitioners in data-intensive organizations, besides undertaking case-based research to understand the current industry practice and develop case studies for classroom teaching.

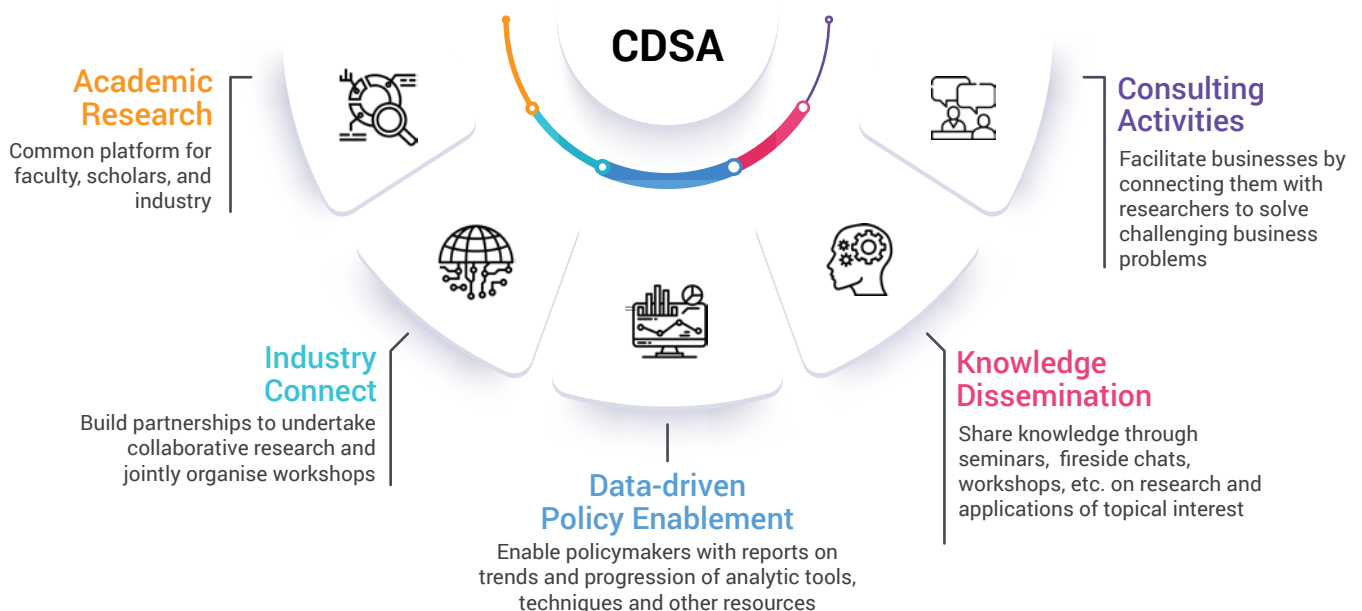
Furthermore, through its collaboration with the industry, CDSA takes up challenging consulting projects of considerable practical importance. These projects are targeted at providing an opportunity for students to participate in projects that aim at outcomes that can further benefit the organisation and the business, at large.

A key offering from the Centre is the Annual Report, which would provide a holistic view of the Data Science and Artificial Intelligence industry, identify challenges and gaps, gauge scope of the industry and offer plausible solutions that can be utilised by the industry and policy makers.

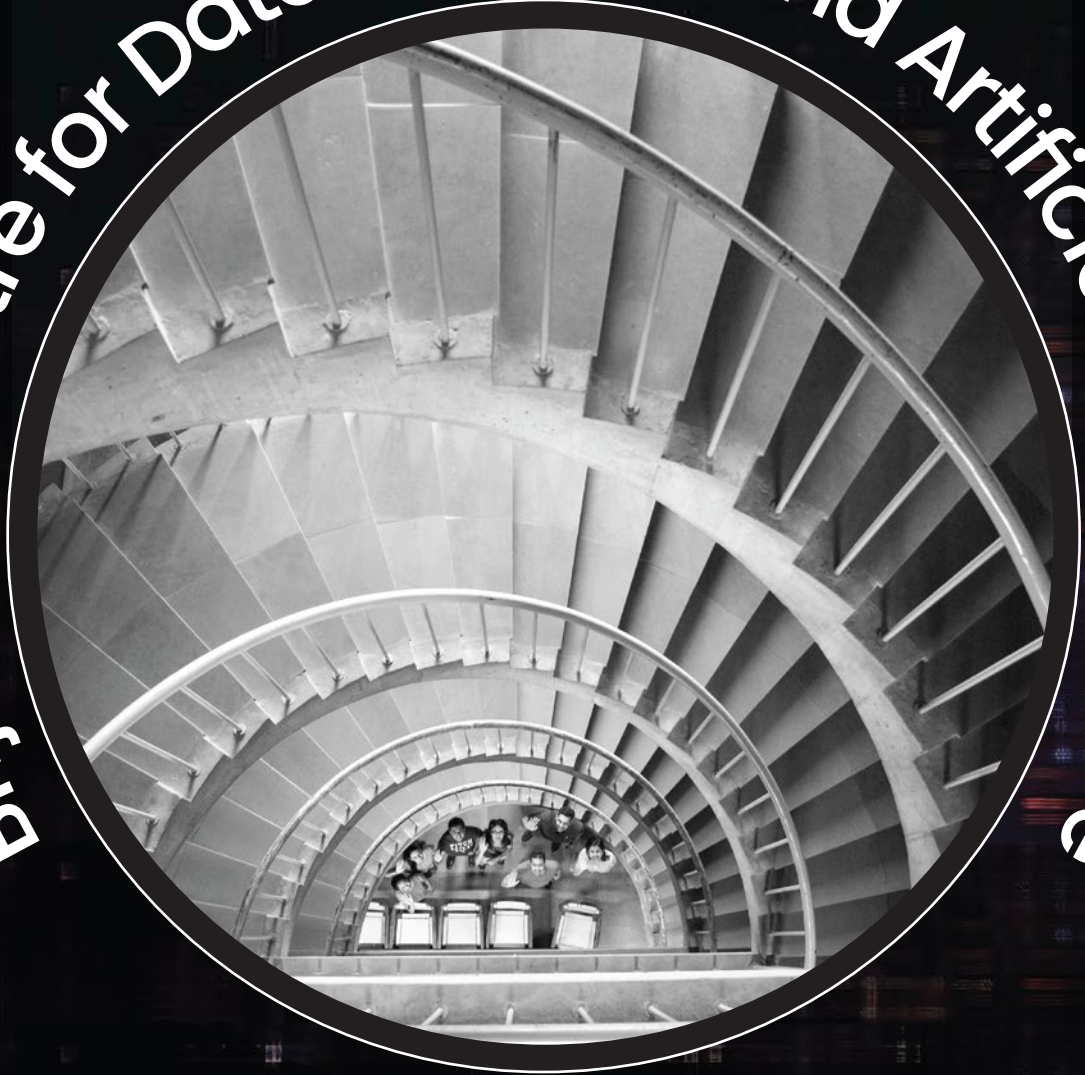
The center is currently headed by Prof. Ankur Sinha (P&QM area, IIMA) and Prof. Anindya S. Chakrabarti (economics area, IIMA)



Centre Activities



Brij Disa Centre for Data Science and Artificial Intelligence



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