Unit # 1

Big data in

- Medicine
- Web Analytix &

Big data in Medicine

- Big data has become a transformative force in the field of medicine, enhancing everything from research and clinical practice to healthcare administration and public health. One of the most popular example of how big data is being used in medicine is Drug discovery.
- Big data is revolutionizing the drug discovery process by enabling pharmaceutical companies, researchers, and healthcare organizations to analyze vast amounts of data more efficiently and effectively. This leads to faster identification of drug candidates, better understanding of disease mechanisms, and ultimately, more effective and safer drugs reaching the market. Following is explanation of how big data is used throughout the drug discovery process which comprises of following steps :

1. *Target Identification*
2. *Lead Compound Identification*
3. *Preclinical Testing*
4. *Clinical Trials*
5. *Post-Market Surveillance*

1. Target Identification

Presence of Big data enables researchers to analyze genomic, proteomic, and transcription data to understand the molecular mechanisms underlying diseases. It enables them to find and understand genes, proteins, or other molecules that are associated with a particular disease.

Big data in Medicine (contd)

By analyzing large-scale genomic datasets, researchers can identify mutations or expression patterns in genes that are implicated in diseases like Diabetes or Cancer . These genes then become potential targets for new drugs.

2. Lead Compound Identification

High-throughput screening involves testing thousands to millions of chemical compounds against a target to identify potential drug candidates (leads). Thus here Big data science can help in managing, analyzing, and interpreting the vast amount of data generated from HTS.

3. Lead Optimisation

Once potential lead compounds are identified, they need to be optimized for efficacy, safety, and drug-like properties. Optimizing a drug candidate requires balancing multiple factors, such as potency, selectivity, toxicity. Big data analytics help to predict how altering a compound's structure will impact its binding affinity, toxicity, and metabolism.

4. Preclinical Testing

Before a drug enters clinical trials, it must undergo extensive safety testing. Big data allows for the use of in silico toxicology, where predictive models are used to assess a compound's toxicity based on historical data and known chemical properties. The silico toxicology method assesses the adverse effects by analyzing structural similarities between the new compound and known toxic substances.

Big data in Medicine (contd)

5. Clinical Trials

Using EHRs and genomic data Big data can be used to identify and recruit patients who are most likely to benefit from a new drug, based on their genetic makeup, medical history, and other factors.

During clinical trials, big data enables real-time monitoring of patient data, allowing for quicker identification of safety issues or positive effects. Trials can be modified based on interim results. This can include changing dosages, modifying patient or even stopping the trial early if the drug poses risks.

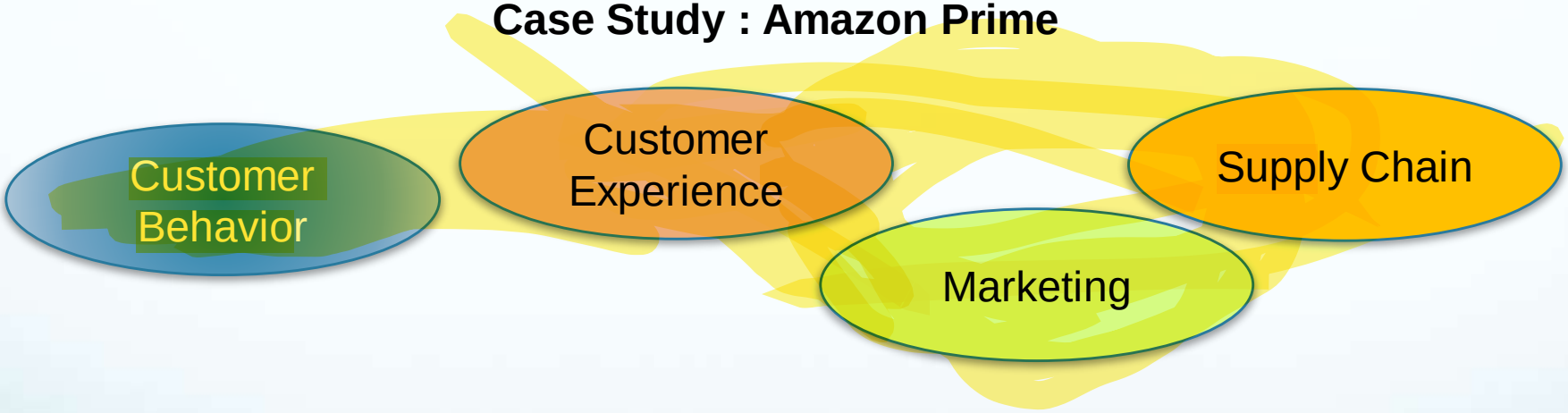
6. Post-Market Surveillance

After a drug is approved and marketed, big data is essential for ongoing pharmaco vigilance i.e the process of monitoring the safety of drugs as they are used in the general population. This involves analyzing data from adverse event reports, EHRs, and other sources.

Web Analytics

Web analytics in the context of big data refers to the process of collecting, analyzing, and interpreting vast amounts of data generated by visitors to a website. This data includes everything from the pages they visit and the amount of time they spend on each page, to their navigation patterns, clicks, interactions, and even demographic information. When applied within a big data framework, web analytics involves handling, processing, and deriving insights from these massive and complex datasets.

Case Study : Amazon Prime



1. Customer Behavior Analysis

- ✓ Amazon has over ~ 200 million Prime members globally.
- ✓ Amazon's recommendation algorithms reportedly contribute to about 35% of total sales
- ✓ Increasing even 1% more members annually through targeted engagement strategies could mean millions of dollars in additional revenue.

Web Analytics (contd)

Transaction Data	• Average order value , Payment methods , Seasonal buying pattern , card abandonment , Shipping costs
Social Media activity	• How customers reacting to brand , Reviews sentiment , Forwards
Interaction Data	• Navigation patterns , Time spent on page , which page , action they take (download , form filled etc)
Demographic	• Age , gender , Income , Location , regional promotions , cultural preferences

Repeat Purchases

Referral

Click analysis

Competitor analysis

Web Analytics (contd)

2. Customer Experience Optimization

Amazon Prime uses web analytics to monitor how users interact with the platform, including load times, navigation paths, and session durations. They analyse the web data from their portal for enhancing every interaction a customer has with their brand, with the goal of increasing satisfaction, loyalty, and advocacy.

User Interface Design	• Minimum clicks , easy to navigate , easy to reach intuitively to area of interest , most preferred platform • Big data analytics on above points
Time Optimisation	• Navigation patterns , Time spent on page , which page , action they take (download , form filled etc)
Customer Support	• Customer experience with chat bot, emails , customer care , 24X7 breaks , Types of queries , Solicit feedback surveys.

Web Analytics (contd)

3. Marketing Analytics

- Amazon Prime over the years have leveragd vast amounts of customer data to deliver highly targeted and effective marketing campaigns. Amazon have over ~ +200 million customer large base so they have segment the marketing accordingly based on demographic information, and even geographic location.
- It's estimated that around **35%** of Amazon's revenue is generated through its recommendation engine, which is powered by big data.

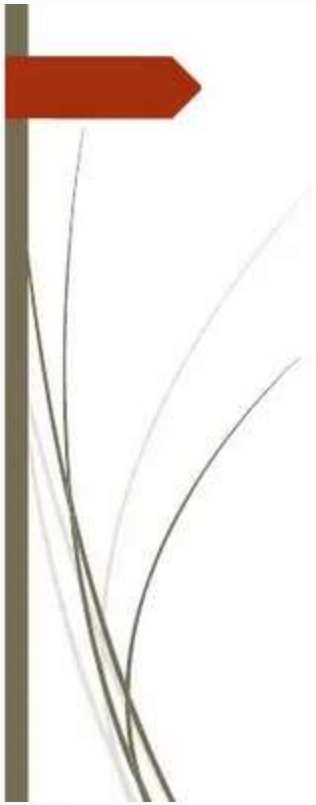
Personalised campaigns	• Prime member in New York receive different promotions than one in Tokyo .
Predictive Analytics	• Based on clicks, searches, purchases, and even dwell time Amazon collects and analysed data to anticipate customer needs , load , time to send Ad / offer , Dynamic Pricing .
Plan Sales Calender	• Amazon Prime day Sale , Big Friday Sale , White Friday , Diwali Sale , Cyber Monday , New Year etc

Web Analytics (contd)

4. Supply Chain

- Amazon's supply chain management is one of the most advanced and is a cornerstone of its success, enabling the company to deliver millions of products to customers around the world quickly and efficiently. The use of big data is integral to Amazon's supply chain, allowing for optimization, real-time decision-making, and the seamless integration of logistics operations.
- 12 million items spread up across 200+ Fulfillment Centers Globally.

Inventory Tracking	• Real time tracking of Big data to send replenishment , Uses Big data even to predict when stock could be over , Analyse historical sales , Market trends and reduces risks of stock outs.
Inventory Automation	• 3 billion packaging and distribution load. • Placement of items in racks , AI system driving Robots continuosly learning from Big data to reduce routing time and erros in shipment.
Supplier & Vendor Management	• 2.5 million vendors across globe , Maintain score card of every vendor thru Big data , Algorithms to meet Prime time delivery compliance.



Thanks