

A BRIEF STUDY ON PREDICTIVE ANALYTICS

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Abstract

The term "predictive analytics" refers to the use of statistics and modelling techniques to make predictions about future outcomes and performance. Predictive analytics looks at current and historical data patterns to determine if those patterns are likely to emerge again. This allows businesses and investors to adjust where they use their resources to take advantage of possible future events. Predictive analysis can also be used to improve operational efficiencies and reduce risk. Predictive analytics is a set of business intelligence (BI) technologies that uncover relationships and patterns within large volumes of data that can be used to predict behaviour and events. Unlike other BI technologies, predictive analytics is forward-looking, using past events to anticipate the future. Predictive analytics statistical techniques include data modeling, machine learning, AI, deep learning algorithms, and data mining. Often, the unknown event of interest is in the future, but predictive analytics can be applied to any type of unknown, whether it be in the past, present, or future. For example, identifying suspects after a crime has been committed or detecting credit card fraud as it occurs. The core of predictive analytics relies on capturing relationships between explanatory variables and the predicted variables from past occurrences and

exploiting them to predict the unknown outcome. It is important to note, however, that the accuracy and usability of results will depend greatly on the level of data analysis and the quality of assumptions.

Paper Identification



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Introduction

Predictive analytics is often defined as predicting at a more detailed level of granularity, i.e., generating predictive scores (probabilities) for each individual organisational element. This distinguishes it from forecasting. For example, "predictive analytics" is "technology that learns from experience (data) to predict the future behaviour of individuals in order to drive better decisions." In future industrial systems, the value of predictive analytics will be to predict and prevent potential issues to achieve near-zero breakdown and further integrate it into prescriptive analytics for decision optimization.

Predictive analytics encompasses a variety of statistical techniques from data mining, predictive modeling, and

machine learning that analyse current and historical facts to make predictions about future or otherwise unknown events.

In business, predictive models exploit patterns found in historical and transactional data to identify risks and opportunities. Models capture relationships among many factors to allow assessment of the risk or potential associated with a particular set of conditions, guiding decision-making for candidate transactions.

The approaches and techniques used to conduct predictive analytics can be broadly grouped into regression techniques and machine learning techniques.

Machine Learning

Machine learning can be defined as the ability of a machine to learn and then mimic human behaviour that requires intelligence. This is accomplished through artificial intelligence, algorithms, and models.

Autoregressive Integrated Moving Average (ARIMA)

ARIMA models are a common example of time-series models. These models use autoregression, which means the model can be fitted with regression software that will use machine learning to do most of the regression analysis and smoothing. ARIMA models are known to have no overall trend but instead have a variation around the average that has a constant amplitude, resulting in statistically similar time patterns. Through this, variables are analysed and data is filtered in order to better understand and predict future values.

Exponential smoothing models are one type of ARIMA method. Exponential smoothing takes into account the difference in importance between older and newer data sets, as the more recent data is more accurate and valuable in predicting future values. In order to accomplish this, exponents are utilised to give newer data sets a larger weight in the calculations than the older sets.

Time series models

Time series models are a subset of machine learning that utilise time series in order to understand and forecast data using past values. A time series is the sequence of a variable's value over equally spaced periods, such as years or quarters in business applications. To accomplish this, the data must be smoothed, or the random variance of the data must be removed, in order to reveal trends in the data.

Predictive Modeling

Predictive modelling is a statistical technique used to predict future behavior. It utilises predictive models to analyse a relationship between a specific unit in a given sample and one or more features of the unit. The objective of these models is to assess the possibility that a unit in another sample will display the same pattern. Predictive model solutions can be considered a type of data mining technology. The models can analyse both historical and current data and generate a model in order to predict potential future outcomes.

Regardless of the methodology used, in general, the process of creating predictive models involves the same steps. First, it is necessary to determine the project objectives and desired outcomes and translate these into predictive analytic objectives and tasks. Then, analyse the source data to determine the most appropriate data and model-building approach (models are only as useful as the applicable data used to build them). Select and transform the data in order to create models. Create and test models in order to evaluate if they are valid and will be able to meet project goals and metrics. Apply the model's results to appropriate business processes (identifying patterns in the data doesn't necessarily mean a business will understand how to take advantage of or capitalise on them). Afterward, manage and maintain models in order to standardise and improve performance (demand will increase for model management in order to meet new compliance regulations).

Regression Techniques

Generally, regression analysis uses structural data along with the past values of independent variables and the relationship between them and the dependent variable to form predictions.

Linear Regression

In linear regression, a plot is constructed with the previous values of the dependent variable plotted on the Y-axis and the independent variable that is being analysed plotted on the X-axis. A regression line is then constructed by a statistical program, representing the relationship between the independent and dependent variables, which can be used to predict values of the dependent variable based only on the independent variable. With the regression line, the programme also shows a slope-intercept equation for the line, which includes an addition for the error term of the regression; the higher the value of the error term, the less precise the regression model is. In order to decrease the value of the error term, other independent variables are introduced to the model, and similar analyses are performed on these independent variables.

KEY TAKEAWAYS

Predictive analytics uses statistics and modelling techniques to determine future performance.

Industries and disciplines, such as insurance and marketing, use predictive techniques to make important decisions.

Predictive models help make weather forecasts, develop video games, translate voice-to-text messages, make customer service decisions, and develop investment portfolios.

People often confuse predictive analytics with machine learning, even though the two are different disciplines.

Types of predictive models include decision trees, regression, and neural networks.

Uses of Predictive Analytics

Predictive analytics is a decision-making tool in a variety of industries.

Banking and Financial Services

The financial industry, with huge amounts of data and money at stake, has long embraced predictive analytics to detect and reduce fraud, measure credit risk, maximise cross-sell and up-sell opportunities, and retain valuable customers. Commonwealth Bank uses analytics to predict the likelihood of fraud activity for any given transaction before it is authorised—within 40 milliseconds of the transaction initiation.

Retail

Since the now-infamous study that showed men who buy diapers often buy beer at the same time, retailers everywhere are using predictive analytics for merchandise planning and price optimization, to analyse the effectiveness of promotional events, and to determine which offers are most appropriate for consumers. Staples gained customer insight by analysing behaviour, providing a complete picture of their customers, and realising a 137 percent ROI.

Oil, Gas & Utilities

Whether it is predicting equipment failures and future resource needs, mitigating safety and reliability risks, or improving overall performance, the energy industry has embraced predictive analytics with vigour. The Salt River Project is the second-largest public power utility in the US and one of Arizona's largest water suppliers. Analyses of machine sensor data predict when power-generating turbines need maintenance.

Governments and the Public Sector

Governments have been key players in the advancement of computer technologies. The US Census Bureau has been analysing data to understand population trends for decades. Governments now use predictive analytics, like many other industries, to improve service and performance, detect and prevent fraud, and better understand consumer behavior. They also use predictive analytics to enhance cybersecurity.

Health Insurance

In addition to detecting claims fraud, the health insurance industry is taking steps to identify patients most at risk of chronic disease and determine what

interventions are best. Express Scripts, a large pharmacy benefits company, uses analytics to identify those not adhering to prescribed treatments, resulting in savings of \$1,500 to \$9,000 per patient.

Manufacturing

For manufacturers, it's very important to identify factors leading to reduced quality and production failures, as well as to optimise parts, service resources, and distribution. Lenovo is just one manufacturer that has used predictive analytics to better understand warranty claims, an initiative that led to a 10 to 15 percent reduction in warranty costs.

Forecasting

Forecasting is essential in manufacturing because it ensures the optimal utilisation of resources in a supply chain. Critical spokes of the supply chain wheel, whether it is inventory management or the shop floor, require accurate forecasts to function.

Predictive modelling is often used to clean and optimise the quality of the data used for such forecasts. Modeling ensures that more data can be ingested by the system, including from customer-facing operations, to ensure a more accurate forecast.

Credit

Credit scoring makes extensive use of predictive analytics. When a consumer or business applies for credit, data on the applicant's credit history and the credit records of borrowers with similar characteristics are used to predict the risk that the applicant might fail to repay any credit extended.

Underwriting

Data and predictive analytics play an important role in underwriting. Insurance companies examine policy applicants to determine the likelihood of having to pay out for a future claim based on the current risk pool of similar policyholders as well as past events that have resulted in pay-outs. Predictive models that consider characteristics in comparison to data about past policyholders and claims are routinely used by actuaries.

Marketing

Individuals The World Health Organization's work in this field looks at how consumers have reacted to the overall economy when planning a new campaign. They can use these shifts in demographics to determine if the current mix of products will entice consumers to make a purchase.

Active traders, meanwhile, look at a variety of metrics based on past events when deciding whether to buy or sell a security. Moving averages, bands, and breakpoints are based on historical data and are used to forecast future price movements.

Benefits of Predictive Analytics

There are numerous benefits to using predictive analysis. As mentioned above, using this type of analysis can help entities make predictions about outcomes when there are no other (and obvious) answers available.

Investors, financial professionals, and business leaders are able to use models to help reduce risk. For instance, an investor and their advisor can use certain models to help craft an investment portfolio with minimal risk to the investor by taking certain factors into consideration, such as age, capital, and goals.

There is a significant impact on cost reduction when models are used. Businesses can determine the likelihood of success or failure for a product before it launches. Or they can set aside capital for production improvements by using predictive techniques before the manufacturing process begins.

Predictive analytics gives accurate and reliable insights, helping organisations solve problems and identify opportunities. Such as:

Detecting Fraud

Predictive analytics can identify patterns to detect and prevent criminal behaviour. As the importance of cybersecurity grows, predictive analytics can assist in detecting anomalies that may indicate cyber vulnerabilities and threats. This helps organisations put

relevant procedures in place and keep their data and businesses safe from fraud and other online threats.

Reducing Risk

Predictive analytics is used in the finance and insurance sectors to construct accurate and reliable pictures of customers in order to help with effective decision-making. For example, credit scores determine the creditworthiness of an individual, which helps reduce the organization's risk.

Optimizing Marketing Campaigns

Determining customer responses and purchases is very important in marketing strategies, and predictive analytics helps analyse data to identify new opportunities to attract or retain customers.

Improving Decision-Making

Predictive analytics allows for more advanced decision-making. The more data that the software has available, the better-informed decisions you can make. It can identify patterns and trends in large amounts of data, providing organisations with insight that previously may not have been available.

Improving Efficiency in Operations

Predictive analytics helps to forecast inventory and manage resources to make organisations more efficient, optimise performance, and increase revenue. It helps them

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