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Forecasting European trade mark and design filings: An innovative approach including exogenous variables and IP offices' events

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ABSTRACT

Both national and international Intellectual Property (IP) offices need to adopt and use more reliable and efficient forecasting systems to improve their strategic planning and budgetary outlook. The European Union Intellectual Property Office (EUIPO), through the European Observatory on Infringements of Intellectual Property Rights, has conducted a research to evaluate the forecasting methodologies currently used at IP offices. Novel forecasting approaches for trade marks and designs have also been analysed. This paper discusses the classic forecasting techniques and shows the improved results that are obtained when innovative techniques based on artificial intelligence with the inclusion of exogenous variables are used.

Contents

1. Introduction

The need for precise and efficient forecasting systems in intellectual property (IP) offices all around the world requires a revision of the existing IP-forecasting methodologies and a search for innovative techniques. Accurate forecasts of patent, trade mark and design filings are crucial for successful strategic planning, operative management and budgetary design at IP offices. Using accurate and converged forecasting systems in IP offices has many advantages, such as [1]:

- Streamlining the operational structure of IP offices, knowing the possible workload in advance for efficient allocation of resources for operations.
- Increased quality of service to users through prior planning based on the number of trade mark and design filings and applications expected in the future. It will improve efficiency by optimising processes and operations to reduce bottlenecks and to increase timeliness in the process towards final registration, minimising the costs involved and delays in the procedure.
- Better strategic and financial planning to fulfil an IP-organisation's future goals. Knowing the number of applications and

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filings in advance could improve overall planning at IP offices to a great extent.
- Identification of leading indicators associated with the series of trade mark and design filings and the impact of different policies (fees, means of filing, promotion exercises, etc.) or macroeconomic changes (e.g. accession to the European Union).
- Improving coordination with other international IP offices by sharing knowledge and best practises.

For trade mark and design offices, the availability and use of forecasting systems capable of generating precise forecasts of future trade mark and design filings are valuable to fulfil their organisational goals. The adoption of a new generation of advanced statistical and computer science techniques based on artificial intelligence (AI) and data science could enhance this. These methods are already used in other areas, such as information technologies, engineering, energy, climatology, biotechnology and health, robotics, business and finance and are increasingly used in prediction research projects in leading private and public organisations [2,3].

At European level, the European Union Intellectual Property Office (EUIPO) is a decentralised agency of the European Union (EU) that offers IP rights protection to business and innovators across the EU and beyond. In 2015, they received around 130000 EUIPO Trade Mark (EUTM) applications (direct and indirect EUTMs) and 100000 Registered Community Designs (direct and indirect RCDs). This means that there are about 1 million EUTMs and 0.5 million RCDs in force that offer intellectual property protection to companies and individuals in a market of more than 500 million consumers.

EUIPO initiated a project in 2013 to evaluate and test the best methods for predicting trade mark and design filings and/or applications using the latest forecasting technologies. The project resulted in the development of a forecasting tool powered by an improved forecasting methodology for the European Trade mark and Design Network (ETMDN), which is a network that connects EU intellectual property offices and user associations. The working group consisted of experts from the national IP offices of Denmark, Hungary, Poland, Portugal, Spain, UK and EUIPO. The European Patent Office (EPO) acted as an observer. This project was supported by the Cooperation Fund, which was established in 2010 following an extraordinary meeting of the EUIPO governing bodies (Management Board and Budget Committee). The Fund is run in partnership with the EU national and regional intellectual property offices, all of which play a vital role in developing its tools and services, which are designed to harmonise working methods at national and regional office level across the EU 28. To date, the Cooperation Fund has delivered 21 products and e service solutions, of which the forecasting project was one.

The goal of this study is to evaluate the suitability and effectiveness of different methodologies to predict the number of trade mark and design filings in the short and medium term, including exogenous variables or predictors that help explain the changes in these volumes. The starting point for the research was the aggregate annual data on national trade mark and design filings from 1996 to 2015. The research analyses whether methodologies such as Support Vector Machines, Artificial Neural Networks and Linear Regression Tree techniques are more powerful, flexible and adequate in the presence of non-linearity, trend patterns, complexities, breaks, outliers and location shifts in the trade mark and design forecasted time series, compared to classic forecasting techniques [4,5]. These techniques are consistently considered to outperform conventional forecasting techniques, such as ARIMAX (ARIMA with exogenous inputs) and other classic techniques [6,7].

This paper is organized into five sections. The first section analyses the main prediction methods commonly used at IP offices and international organisations. The second section describes the different advanced and new methodological approaches used to forecast trade mark filings and applications quantitatively. Section 3 explains the methodological approach of the research and the main variables used in the forecasting process. Section 4 shows the results of the main forecasting techniques applied to actual trade mark and design time series, including a comparison of the prediction techniques results in terms of performance and also real use case tests with out-of-sample predictions. Finally, the last section focuses on the main conclusions of the research and the possible directions for future research.

2. Prediction methods used at IP offices

Currently, there are different lines of research and methodological approaches related to IP forecasting, although the vast majority of the research methodologies are only oriented towards predictions for patent applications. The techniques that IP offices have traditionally used in research for patent and trade mark forecasting are classic techniques, such as trend extrapolation, exponential smoothing, autoregressive and ARIMA (Autoregressive Integrated Moving Average) family techniques. However, prediction techniques used by some IP offices also involve the use of non-quantitative techniques, such as surveying IP experts or users. Table 1 shows the forecasting techniques for patents used in some of the large IP offices, and Table 2 shows the forecasting techniques used for trade mark prediction.

One of the most frequently used forecasting techniques for patent predictions is the extrapolation of trend techniques using simple trend models. Almost all the major patent offices in the world use this type of trend extrapolation - alone or combined with other forecasting techniques. For instance, the European Patent Office uses a combination of forecasting model results from trend extrapolation techniques (linear, quadratic and autoregressive) and previous annual forecasts to create a cloud of prediction results that generates the final forecast for the predicted patent time series, found in the densest area of the prediction models cloud [8].

Apart from the trend extrapolation techniques, another forecasting technique commonly used to forecast future patent applications and filings is the exponential smoothing technique, such as Holt-Winters [9], whether simple or for damped trends. These methods, with semi-automatic estimation of parameters, are usually a first step in the analysis of time series for later application of more complex models. More advanced techniques, such as econometric models and ARIMA family techniques are used in organisations like WIPO, USPTO or EPO [10]. These models can include time series and econometric models with regressors or exogenous variables, also including ARIMA methods with a transfer function, ARIMAX or ARIMA with interventions.

The Holt-Winters forecasting method uses recursive filtering techniques to capture the trend, level and seasonal components of the time series and generates a prediction. On the other hand, ARIMA models [6] are commonly used in forecasting IP time series and combine three different processes in one model: autoregressive (AR), integrated (I) and moving average (MA). The transfer function models allow the incorporation of different additional input time series to the ARIMA technique. Different exogenous variables (input time series) can be included in the ARIMAX technique using a transfer function model, whereas the ARIMA with interventions, also known as intervention model, includes pulse or step functions to forecast the response to certain interventions.

Some of these offices also combine these forecasting techniques with the results from different applicants or expert survey methods (i.e. Delphi method), a more qualitative approach to predict future trends based on the opinions and/or declared intentions of users and IP experts [8]. Based on publicly available documentation, some