Prescriptive Analytics System for Scholar Research Performance Enhancement

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Abstract. We introduce a prescriptive analytics system, InSciTe Advisory, to provide researchers with advice for their future research direction and strategy. It consists of two main parts: descriptive analytics and prescriptive analytics. Descriptive analytics provides results from research activity history as well as the research power index for the designated researcher. Prescriptive analytics suggests a group of role model researchers to the researcher, as well as methods to adopt their best practices. The prescription for the researcher is provided according to 5W1H questions and their corresponding answers. All of the analytical results and their explanations related to the given researcher are automatically generated and saved to a report. This researcher-centric prescriptive analytics framework is expected to be a useful tool to understand the designated researcher from the perspective of prescriptive and descriptive analytics. We evaluated user satisfaction results for InSciTe Advisory and Elsvier Scival by five test users. The result of the evaluation demonstrated that user satisfaction of InSciTe Advisory is 126.5% higher than Scival.

Keywords: Prescriptive Analytics, Descriptive Analytics, Research Performance Enhancement, User Satisfaction Evaluation, InSciTe Advisory.

1 Introduction

Researchers should predict the future and develop appropriate strategies to respond to predictions, in order to strengthen research competitiveness. It is import to identify researchers' competencies and skill level through the analysis of past and present data; based on this identification, the research objective should be defined. We need to determine an optimum methodology to achieve the defined research objective.

In this study, the analysis methods, descriptive analytics and prescriptive analytics, are utilized to provide researchers' future research strategies. Descriptive analytics is the most common and well understood type of analytics, and many analytic tools commonly support this. Predictive analytics endeavors to predict the future, while prescriptive analytics suggests decision options in conjunction with their implications[1]. Prescriptive analytics first emerged in 2013, and was developed based on Gartner group's emerging technology, Hype cycle. Prescriptive Analytics is the third and final phase of business analytics, which includes descriptive, predictive, and pre-

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scriptive analytics[2]. Prescriptive analytics is a set of mathematical techniques that computationally determine a set of high-value alternative actions or decisions, given a complex set of objectives, requirements, and constraints, with the goal of improving business performance. Hitherto, the majority of business intelligence solutions or decision-making support systems have been focused on descriptive investigate to investigate the past or to provide present statistical information, thus showing insufficient performance to support strategic predictive abilities.

To solve this issue, we have been developing an automated technology analytics system, InSciTe Advisory. We have tackled predictive analytics as well as descriptive analytics in the technology domain, and we are now developing an automated prescriptive analytics service. Our goal is to provide researchers with role model recommendations and advice on considering research methods of the role model group. In addition, in order to evaluate the user satisfaction of InSciTe Advisory service, we compared InSciTe Advisory's user satisfaction results with the user satisfaction of the current best information system, Elsevier Scival.

2 Descriptive and Prescriptive Analytics of InSciTe Advisory

InSciTe Advisory is a prescriptive analytics system for scholarly research performance enhancement. The system analyzes several thousand data sources from different categories such as papers, patents, reports, web news, web magazines, and collective intelligence data. The InSciTe Advisory service provides two analytical and advising services, descriptive analytics and prescriptive analytics.

The descriptive analytics service provides an analysis of researcher' present skill level and consists of the researcher activity history service and researcher power index service that analyzes the researcher' multi-dimensional competencies. The researcher activity history service provides information on researchers' activities from past to present, which were analyzed in terms of their scholarly activity, career activity, and industrial activity. On the other hand, the researcher power index service proposes researcher' power index values by analyzing researchers' competencies from the perspective of nine different indexes, which include commerciality, scholarity, influentiality, diversity, durability, technology emergability, partner trend, market trend and supply & demand. This service is used to compare the relative levels between researchers through the power index of researchers, and seek the researcher' role model group (See Fig.1.). Technological characteristics of the role model group, researcher power index, and representative researchers of the group are described[3].

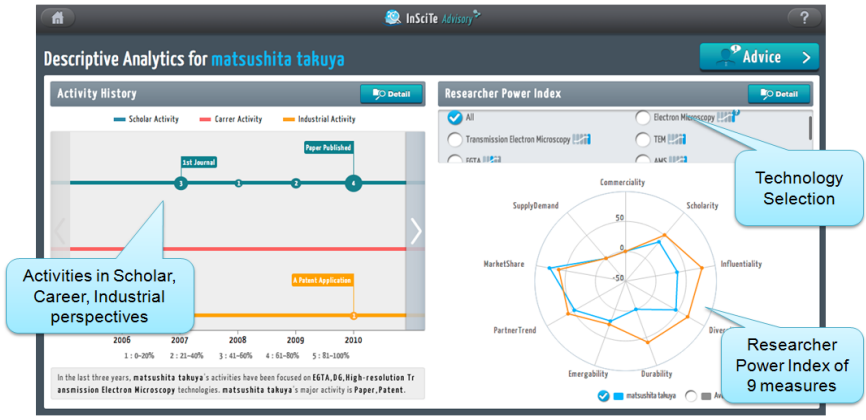


Fig. 1. Descriptive Analytics for Researcher

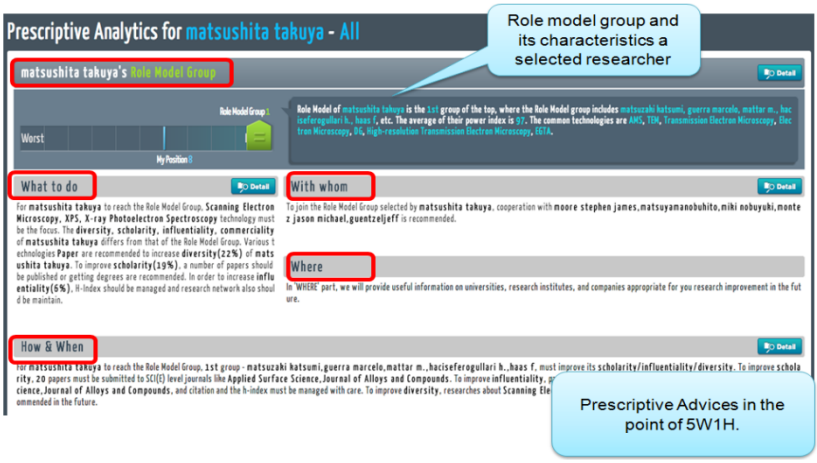


Fig. 2. Prescriptive Analytics based on 5W1H Questions and Answers

The prescriptive service provides strategies and methods for present researchers to adopt the practices of the role model group obtained through the descriptive analytics service. Furthermore, it proposes 5W1H as the method to achieve the optimum objectives based on the analyzed results of the present researcher' competencies (See Fig.2.). 5W1H provides the necessary strategies for determining the aforementioned role model researcher group from the perspective of the following actions taken in regard to the research. These actions include: how, what, with whom the research should be carried out, where, when, and why. As such, the optimized scenarios and predicted results that support the selection of the role model researcher group are provided [4].

3 Evaluation of User Satisfaction

In order to evaluate the usefulness of the InSciTe Advisory system, we decide to compare the user satisfaction of this system to the user satisfaction of the current best information system. We performed a multi-dimensional evaluation to measure user satisfaction from the perspective of the following eight requirements, which can be broadly divided in terms of information service quality and information reliability[5]. The eight requirements include accurateness, completeness, information accuracy, information completeness, information navigability, information individualization, accuracy and fullness.

- Information Service Quality Dimension

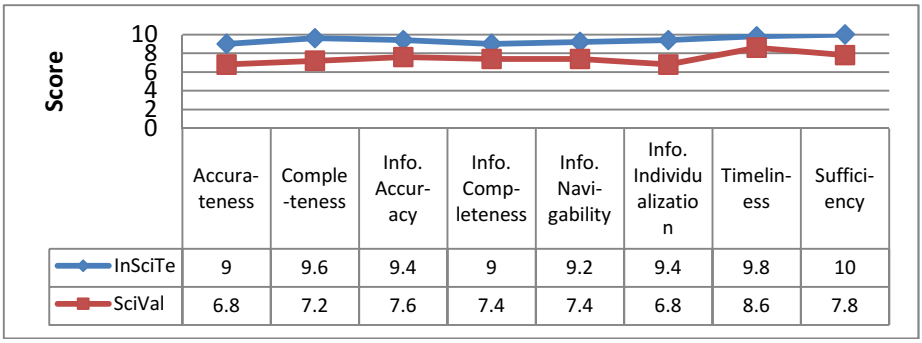
— Accurateness: Are the results of the analysis accurate?
— Completeness: Are the work process results error-free and completed clearly?
— Information accuracy: Does the information comply with the information purpose and needs of users?
— Information completeness: Is the provided information free of inconsistencies, and does it promote intuitive understanding of the information?
— Information navigability: Can information be searched easily and quickly, and can the overall overview of the information be easily understood?
— Information Individualization: Can the information be customized according to the user's preferences?

- Information Reliability Dimension

— Timeliness: How accurate is the information at the time the transaction is executed, according to the user's requirements?
— Sufficiency: Does the information reflect the user's requirements and meet the user's expectations sufficiently and completely?

Research by Nielson and Landaur indicated that most HCI problems could be identified through an evaluation of 5~6 test users[6]; therefore, to evaluate user satisfaction, we assembled a group of five test users. This group was comprised of experts who were requested to use the InSciTe Advisory service. Elsevier Scival, the current best information system based on the SCOPUS journal data, was selected as the evaluation target to be compared to InSciTe Advisory. Scival has service models comprised of experts, funding, spotlight, strata, analytics, reviewer, finder, etc.

In the user satisfaction evaluation method, the test users use both systems being compared in the evaluation, and measure the satisfaction score of each evaluation system according to eight items. The score by item includes the following absolute evaluation values: very excellent = 10, excellent = 9, normal = 8, unsatisfactory = 7 and very unsatisfactory = 6. Fig.3. displays the test results; total score of InSciTe Advisory is 75.4 and the total score of Elsevier Scival is 59.6. The user satisfaction of InSciTe Advisory was 126.5% higher than the user satisfaction of Scival.



	Accura-teness	Comple-teness	Info. Accur-acy	Info. Comp-leteness	Info. Navi-gability	Info. Individualization	Timelin-ess	Sufficiency
InSciTe	9	9.6	9.4	9	9.2	9.4	9.8	10
SciVal	6.8	7.2	7.6	7.4	7.4	6.8	8.6	7.8

Fig. 3. Evaluation Result

4 Conclusion

The present study described the details of the InSciTe Advisory system, which supports future research direction by analyzing the big data of researcher's past and present work, in order to strengthen the researchers' competencies. InSciTe Advisory provides two main services descriptive and prescriptive analytics services based on the analysis of various researcher-centric data. The analysis service identifies the current research competencies of the researchers, and recommends role model researchers accordingly. Furthermore, the service provides strategies for adopting the best practices of the role model researcher group that is analyzed through the 5W1H method, to enhance the research competitiveness of target researchers. Test results confirmed that the user satisfaction of InSciTe Advisory was 126.5% higher than the user satisfaction of Scival.

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