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Future sign detection in smart grids through text mining

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Abstract

Policymakers and stakeholders need insights into smart grid issues related to the technologies, markets and so on to drive more effective smart grid projects. A comprehensive examination of relevant references would be helpful in this regard, but extensive time and efforts are required to obtain the insights. We seek to explore which smart grid issues have been highlighted and will emerge in the future using the future sign searching technique through text mining. As a result, keywords such as ‘gateway,’ ‘university,’ ‘oil’ and so on were highlighted as weak signals. Furthermore, this study helps to promote the development of scientific research in future sign analysis through text mining by presenting some challenges in the research methodology. Especially, we need to examine which weak signals have the potential to develop into strong signals in further research.

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1. Introduction

In order to achieve its national goal of green growth, the Korean government published a national roadmap for a smart grid on January 25, 2010, implemented the Jeju Island smart grid pilot project until May 2013 (Dec 2009–May 2013), and is planning to implement the smart grid promotion project from 2016 to 2025. The smart grid deployment project is still in its infancy and will go through many different stages in the future.

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Policymakers and stakeholders need insights into smart grid issues related to the technologies, markets and so on to drive more effective smart grid projects. A comprehensive examination of relevant references would be helpful in this regard, but extensive time and efforts are required to obtain insights into which issues have been noted over time and which themes will emerge in the future.

In this study, we seek to explore which smart grid issues have been highlighted and will arise in the future using the future sign searching technique through text mining. This way will make it possible to effectively look into large documents in a short period. Furthermore, we also investigate the limitations of the future sign searching method through text mining, which is used in this study, and derive follow-up research directions to overcome the limitations. This study will be a basis to provide insights into the improvement of smart grid competitiveness.

2. Future sign detection through text mining

2.1. Understanding a future sign through a weak signal

The smart grids will rapidly transform the energy sector regarding business models and industry structure [1–4]. An extensive review of smart grid references will be of great help for researchers to understand dynamically changing aspects of smart grid industry. However, huge time and efforts are required to gain insight into which issues have been noted over time and which themes will emerge in the future.

A weak signal analysis is one of the methods, often used to find a future sign and insight into a specific topic. Here the weak signal refers to current oddities and strange issues capable of predicting a future change, that is, a signal indicating a beginning of a future society change as well as an event that possibly takes place in the future.

A weak signal can develop into a strong signal, which then develops into a trend or a mega-trend over time. Whereas a trend is a phenomenon already known to many people, a weak signal may only interest some people and be recognized as a potential trend in its early stage. Generally, a weak signal is interpreted as a signal for what trend will be created rather than as a form of a trend.

The term weak signal was first proposed by Ansoff [5]. Ansoff developed the concept of a weak signal as an alternative to strategic planning for a company in the 1970s and 1980s. He defined a weak signal as symptoms of possible change in the future and asserted that strategic planning was rational when a historical trend developed gradually, but not effective in dealing with unexpected events. He thought that as social progress accelerated and many uncertain variables appeared, the traditional techniques such as forecasting and scenario planning, the representative strategic planning methodologies, were lacking predictability of the future [5].

Coffman [6] and Kamppinen et al. [7] defined Ansoff's weak signal more specifically. Coffman (1997) defined a weak signal as a signal (i) that will affect the business or the business environment; (ii) that is new and unexpected to the signal receiver though others may already perceive it; (iii) that is sometimes difficult to track amid other noise and signals; (iv) that is a threat or an opportunity to a particular group; (v) that is often treated with scorn by those who 'know' ; (vi) that usually has a substantial lag time before it will mature and become mainstream; and (vii) that therefore represents an opportunity to learn, grow, and evolve. This definition is one that quite faithfully follows the original concept of Ansoff, expresses it in detail, and makes it more concrete. Kamppinen et al. from the same perspective regarded a weak signal as an individual event or a series of interrelated events that may not seem to be essential at the time of occurring but will be substantial or even critical in the future. They thought that the relation between this weak signal and future events might not be explained with certainty by a statistical technique such as a historical time series.

Later, Hiltunen [8] systematized the weak signal using the concept of a 'future sign.' Hiltunen explained a future sign in three dimensions of signal, issue, and interpretation. In Hiltunen's future sign space, when a sign is in a low level of signal, issue, and interpretation, it is classified as a weak signal; when it is in a high level of the respective dimensions, it becomes a strong signal. Here the signal means the visibility or the number of the future sign; the issue means the number of the event indicating how far the future sign is spreading; and the interpretation means how many people understand the meaning of the future sign.

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