A enhanced text-based approach to identify and trace technological topics: A case study of additive manufacturing

Introduction

Technological innovation is a continuous and dynamic process that spans the entire life cycle of an idea, from scientific research to production. The accelerated competition of technological innovation and the increasingly complex process of technological changes propose a higher challenge to trace the evolution of technology, especially for the emerging technology. How to systematically and effectively analyze the patent literature, so as to more comprehensively, deeply and accurately understand the process and trend of technological evolution, is of great significance to the improvement of technological innovation and technological competitiveness.

Methodology

Analyzing patent classification information with some statistical methods along with the time axis can reveal the technical evolution process of a certain field. It's noteworthy that some researchers have utilized the structured information in patent descriptions to analyze the evolution of technology development and to forecast technology development trends (Jun and Lee 2012). Although the co-category analysis of patent classification can reveal the evolution process of technology sub-field, it is still difficult to describe the evolution process and trend of technology development in a detailed and in-depth way because it does not go deep into the content of patent text (Huang et al. 2017).

Focusing on the core issue of identifying and tracing technological topics, this paper attempts to present a systematic framework of bibliometrics and text mining techniques to help the field of technology management analyze the evolution of technologies by using patent documents as the data source, shown as Figure 1.

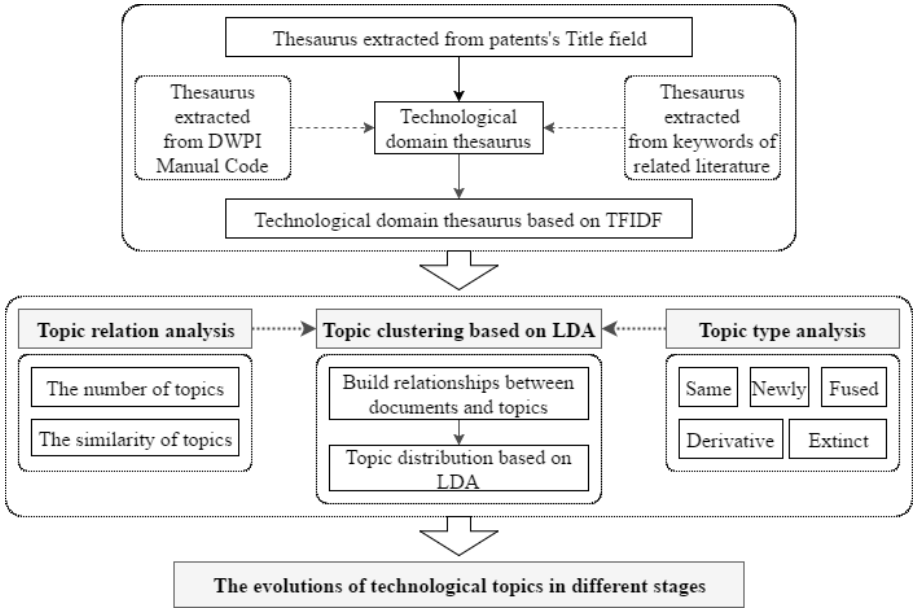

Figure 1: The framework of tracing technological evolution based on enhanced text-based approach

Preliminary Results

Additive manufacturing, as an emerging technology with great representativeness and development potential, explores the technology development path in different stages of its technology life cycle, which is of positive significance for enterprises to formulate technology strategy. In this paper, we search the patent information from Thomson Innovation platform that brings the world's most comprehensive

international patent coverage together. Considering the time lag of when patents are filed, we have received 16349 records by refining the publication period between 1985 and 2015. The reason for setting 1985 as the beginning year of the acknowledged first published additive manufacturing related patent is that EP171069 was applied to the additive manufacturing system in 1985. The technological evolution of additive manufacturing is based on the process presented in *Methodology* section shown as Figure 2.

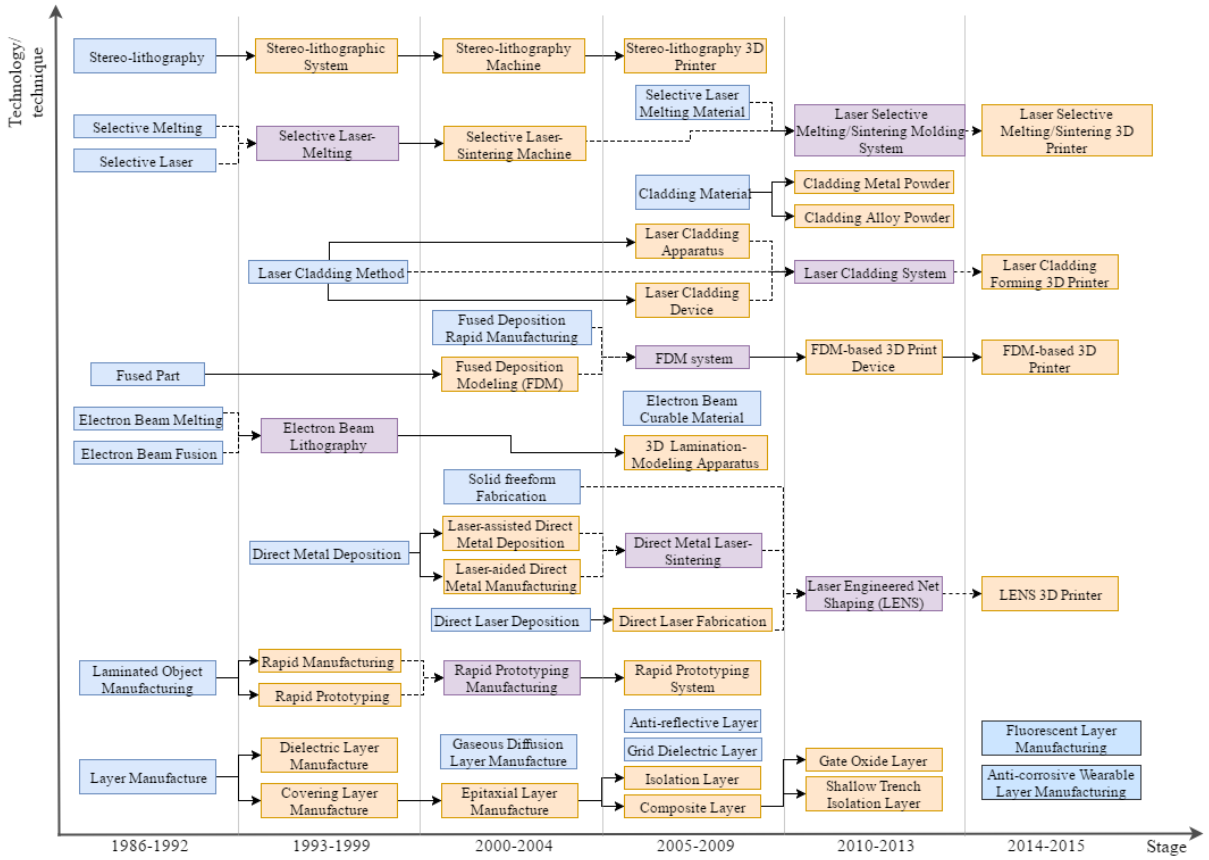

Figure 2: The technological evolution of Additive Manufacturing based on enhanced text-based approach

Concussion and Discussion

This papers proposes a approach to extract the technological thesaurus from patent title, build the corresponding relationship between the patent documents and the technological topics, and then trace the emergence, derivation, fusion and extinction of these technological topics from the perspective of the technology similarity. Such a systematic approach analyzes the distribution of technological topic in each stage and tracks the evolution of these topics comprehensively and meticulously.

When we analyze the evolution of technology through technological thesaurus, it is quite necessary to pay attention to balance the accuracy and coverage during the process of extracting and selecting those thesaurus. Although this paper introduces the DWPI manual code and the keywords of scientific papers as a supplement list, it still needs some expert knowledge to screen and judge them. In addition, the rules of differentiating types of the derivative topics and merged topics need to be further discussed and improved.

References

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Huang, Y. , Zhu, D. , Qian, Y. , Zhang, Y. , Porter, A. L. , & Liu, Y. , et al. (2017). A hybrid method to trace technology evolution pathways: a case study of 3d printing. *Scientometrics*, 111(1), 185-204.