At the interface between the fields of scientometrics and network analysis, many approaches have been developed for studying the structure and development of the scientific literature in a specific research area or on a specific research topic. Clustering techniques, also known as community detection techniques, have been applied to scientometric networks in order to identify clusters of closely related publications or journals \citep[e.g.,][]{Boyack2010,Rosvall2008,Waltman2012}. Such clusters can be considered to represent research areas. Clustering techniques have for instance been employed to identify emerging research areas \cite{Small2014,Wang2018}. Visualization tools have been used to visually represent the structure and development of the literature in a research area, focusing either on visualizations of scientometric networks in general \cite{Chen2006,VanEck2010} or specifically on visualizations of citation networks of publications \cite{Garfield2003,VanEck2014}. Centrality measures have also frequently been applied to scientometric networks, for instance to study the interdisciplinarity of journals \cite{Leydesdorff2007} or the influence of authors \cite{Newman2001}. Various approaches have also been introduced specifically for analyzing citation networks of publications. These for instance include main path analysis \cite{Hummon1989} and transitive reduction \cite{Clough2015}.

In this paper, we introduce a new approach for analyzing citation networks of publications. We propose an indicator called intermediacy. Given two publications dealing with a specific research topic, an older publication and a more recent one, intermediacy can be used to identify publications that appear to play a major role in the intellectual development from the older to the more recent publication. These are publications that, based on citation links, are important in connecting the older and the more recent publication.

Intermediacy somewhat resembles the idea of main path analysis, originally proposed by \citet{Hummon1989}. However, as we will make clear, there are fundamental differences between intermediacy and main path analysis. Most significantly, we will show that main path analysis tends to favor longer citation paths over shorter ones, whereas intermediacy has the opposite tendency. For the purpose of tracing intellectual developments in the scientific literature, we argue that intermediacy yields better results than main path analysis.

This paper is organized as follows. In Section~\ref{}, we define intermediacy, we study the mathematical properties of intermediacy, and we describe algorithms for calculating intermediacy. In Section~\ref{}, we present two cases that provide empirical illustrations of the use of intermediacy. We discuss our conclusions in Section~\ref{}.

Boyack2010: <https://doi.org/10.1002/asi.21419>

Chen2006: <https://doi.org/10.1002/asi.20317>

Clough2015: <https://doi.org/10.1093/comnet/cnu039>

Garfield2003: <https://doi.org/10.1002/asi.10226>

Leydesdorff2007: <https://doi.org/10.1002/asi.20614>

Newman2001: <https://doi.org/10.1103/PhysRevE.64.016132>

Rosvall2008: <https://doi.org/10.1073/pnas.0706851105>

Small2014: <https://doi.org/10.1016/j.respol.2014.02.005>

VanEck2010: <https://doi.org/10.1007/s11192-009-0146-3>

VanEck2014: <https://doi.org/10.1016/j.joi.2014.07.006>

Waltman2012: <https://doi.org/10.1002/asi.22748>

Wang2018: <https://doi.org/10.1002/asi.23930>