

Node-Level Analysis from Graph Theory to Identify Influential Authors

Measuring the Impact of Law Research in SA Courts

INTRODUCTION

There are many ways of measuring the impact of academic research in other academic research. Academic research impact measurements include citation count measures like the h-index. The Faculty of Law at the University of Pretoria, however, wants to understand the impact of law research in the courts of South Africa.

PURPOSE OF RESEARCH

The purpose of the research is to define and explore measures of impact of law research in South African courts through graph theory and subsequent node-level analysis of the network to identify influential authors. The goals of the research are listed as follows:

- Compare and document different metrics for research impact
- Identify seminal research that has had lasting impact

METHODOLOGY

The first step was to transform the three volumes of *Fontes Juris* - a published book that contains source references of the law noted in South African Superior Court Cases since 1828 - into structured data using text mining and a decision tree algorithm to enable graph network modelling.

The next step involved the modelling of the network. A two-mode network (author and judgement pairs) was created to allow for centrality measures to be calculated. The two-mode network resulted in a very sparse (low density) model. The two-mode network was subsequently transformed into a one-mode network resulting in an author-node only network with 60 times higher density.

The final igraph object was produced following these steps:

- Incidence matrix from the two-mode igraph network object using `as_incidence_matrix()` function from igraph library
- Calculate intersection distance of the incidence matrix to calculate edge weights
- Set diagonals of matrix to zero

EXPERIMENTS

A node-level analysis was executed by calculating the following centrality measures for the one-mode (author-only nodes) network:

- Degree Centrality
- Eigenvector Centrality
- Closeness Centrality
- Betweenness Centrality
- PageRank Centrality

The centrality measures were compared with traditional bibliometric indices (including h-index, m-quotient and g-index) for the same collection of data.

RESULTS

The centrality measures were able to identify the authors **VOET**, **GROTIUS** and **HALSBURY** as influential authors in South African courts. Figure 1 shows the judgment citation count of a span of 165 years for the most influential author, **VOET**.

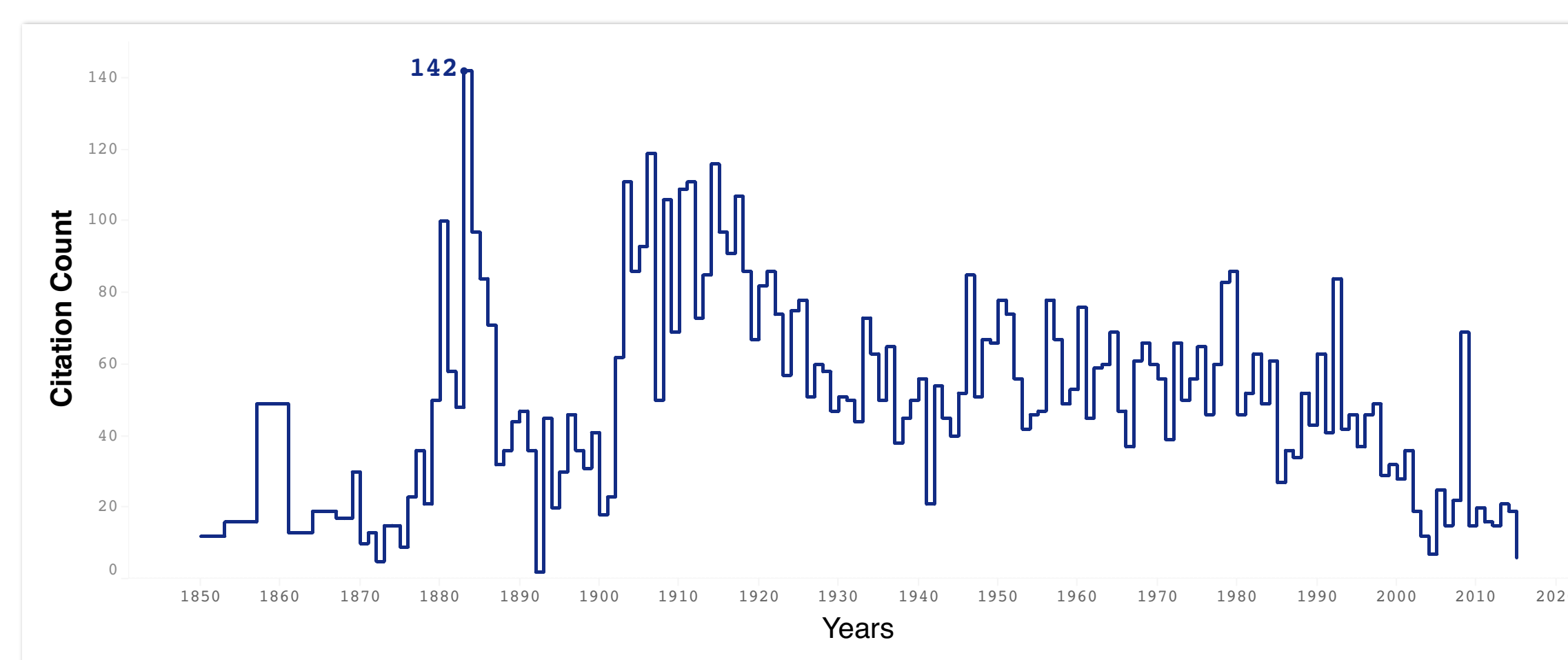
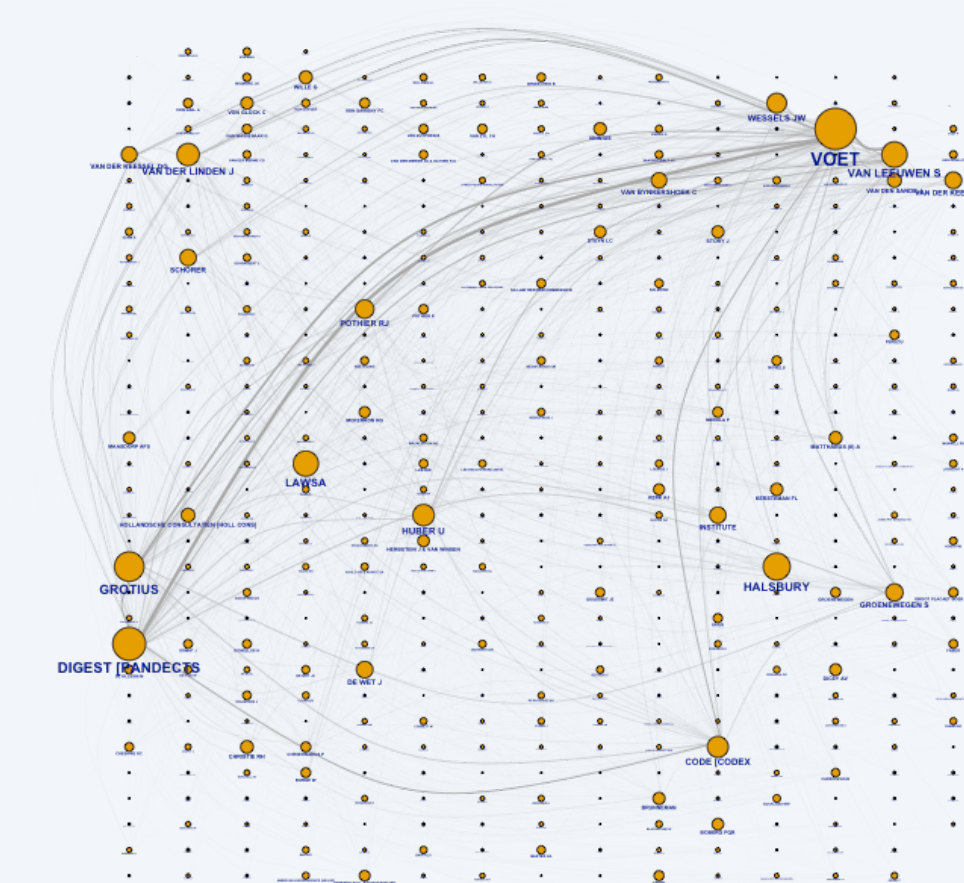
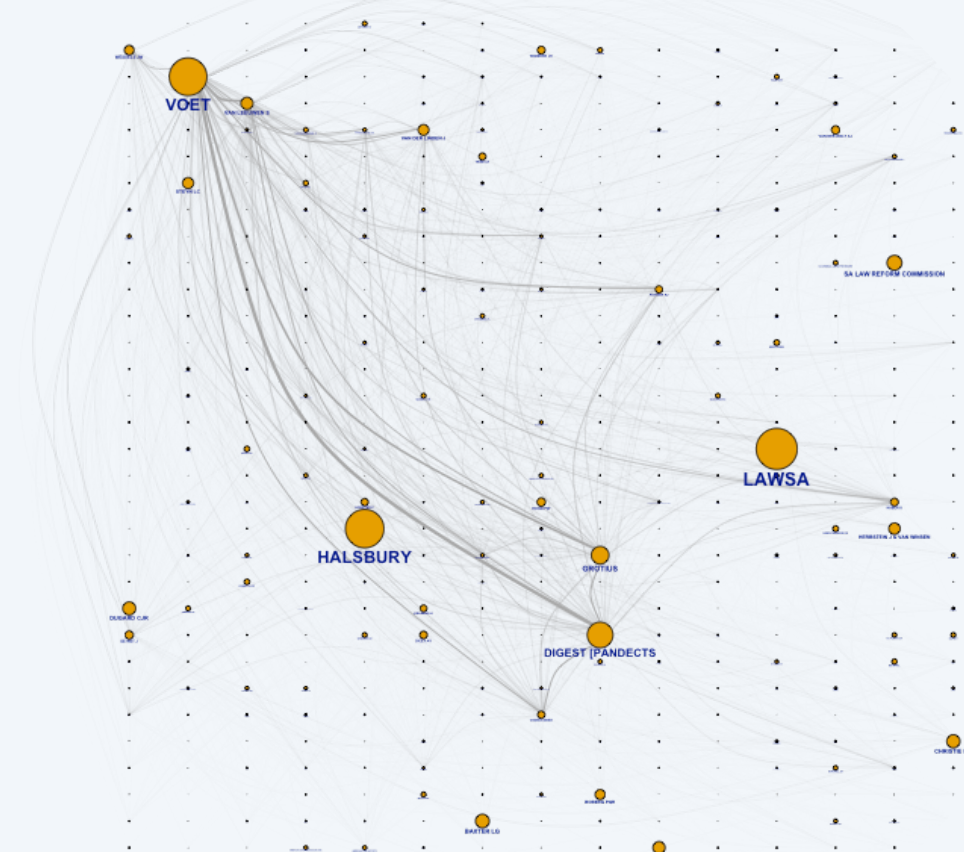


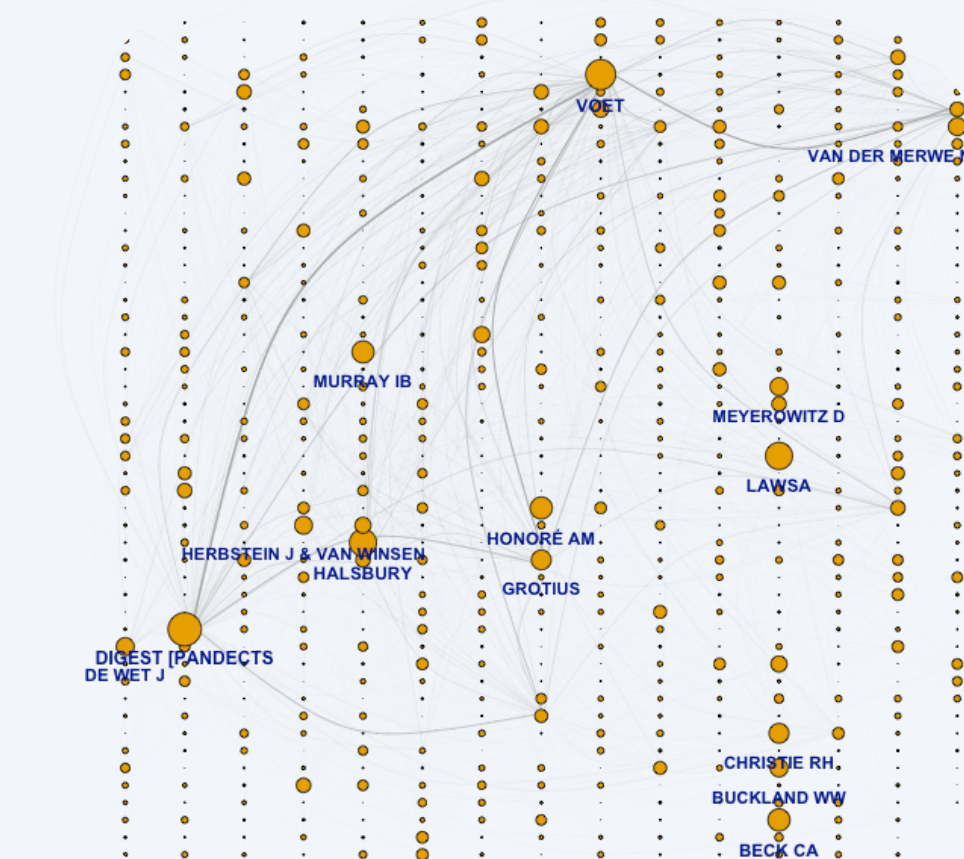
Figure 1 : Citation Count of Years for VOET (author)



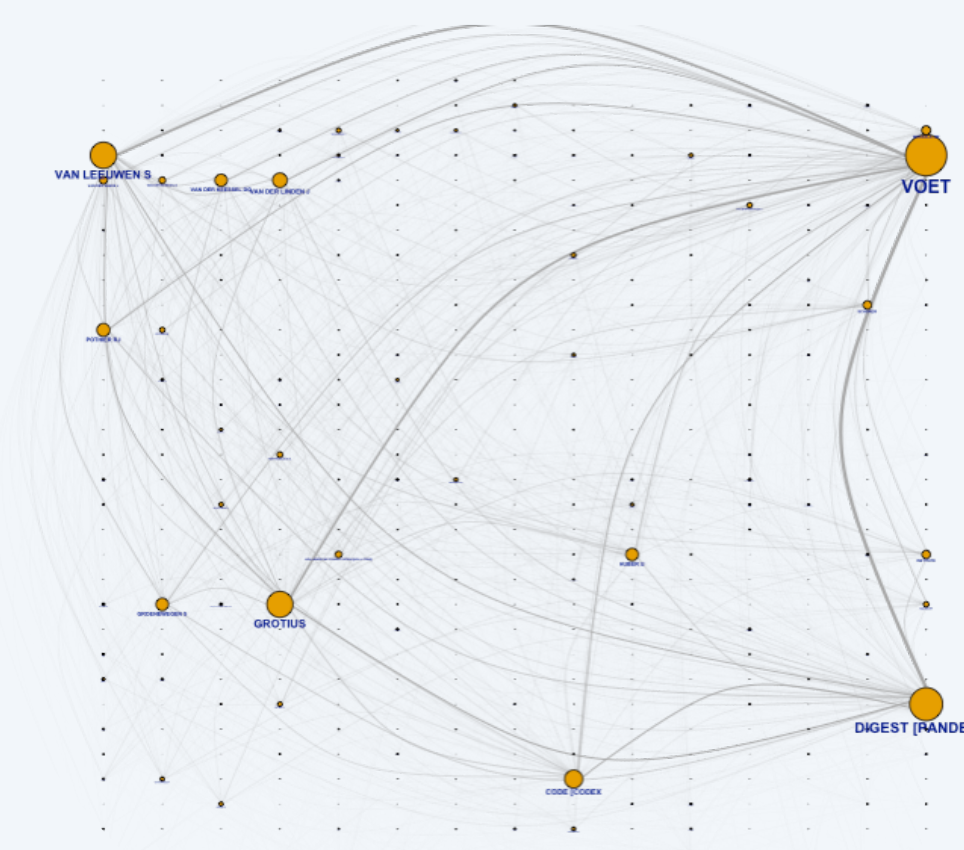
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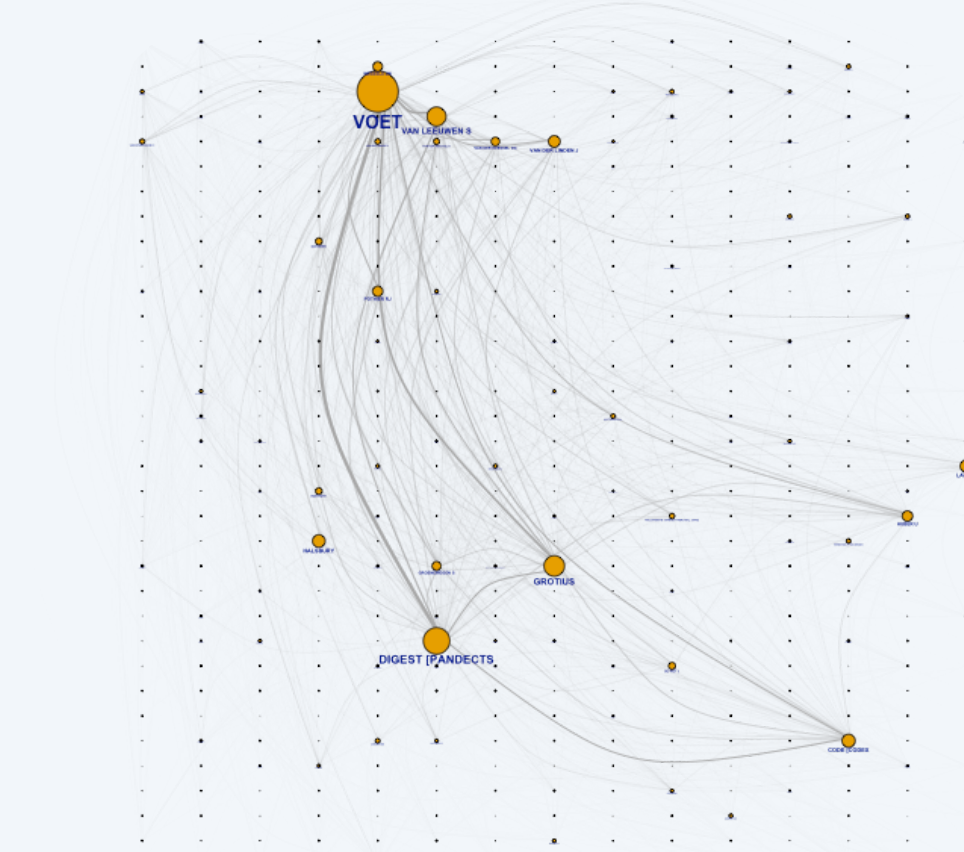
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