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Demand forecasting with four-parameter exponential smoothing

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ABSTRACT

Exponential smoothing methods are powerful tools for denoising time series, predicting future demand and decreasing inventory costs. In this paper we develop a smoothing and forecasting method that is intuitive, easy to implement, computationally stable, and can satisfactorily handle both, additive and multiplicative seasonality, even when time series contain several zero entries and large noise component.

We start with the classical additive Holt-Winters method and introduce an additional smoothing parameter in the level recurrence equation. All parameters are required to lie within [0,1] and estimated by minimizing the one-step-ahead forecasting errors in the sample. Doing so, the errors decrease substantially, especially for the time series with strong trends. The newly developed method produces more accurate short-term out-of-sample forecasts than the classical Holt-Winters methods and the Holt-Winters methods with damped trend.

The performance of the method is evaluated using a battery of real quarterly and monthly time series from the M3-Competition. A simulation study is conducted for further in-depth analysis of the method under different demand patterns. We developed and justified the use of a symmetric relative efficiency

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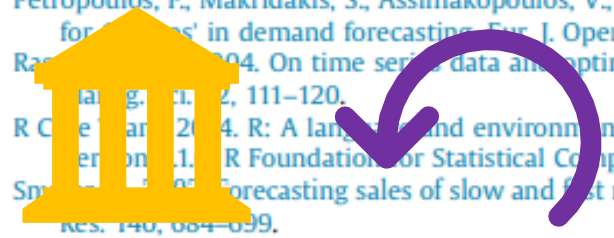

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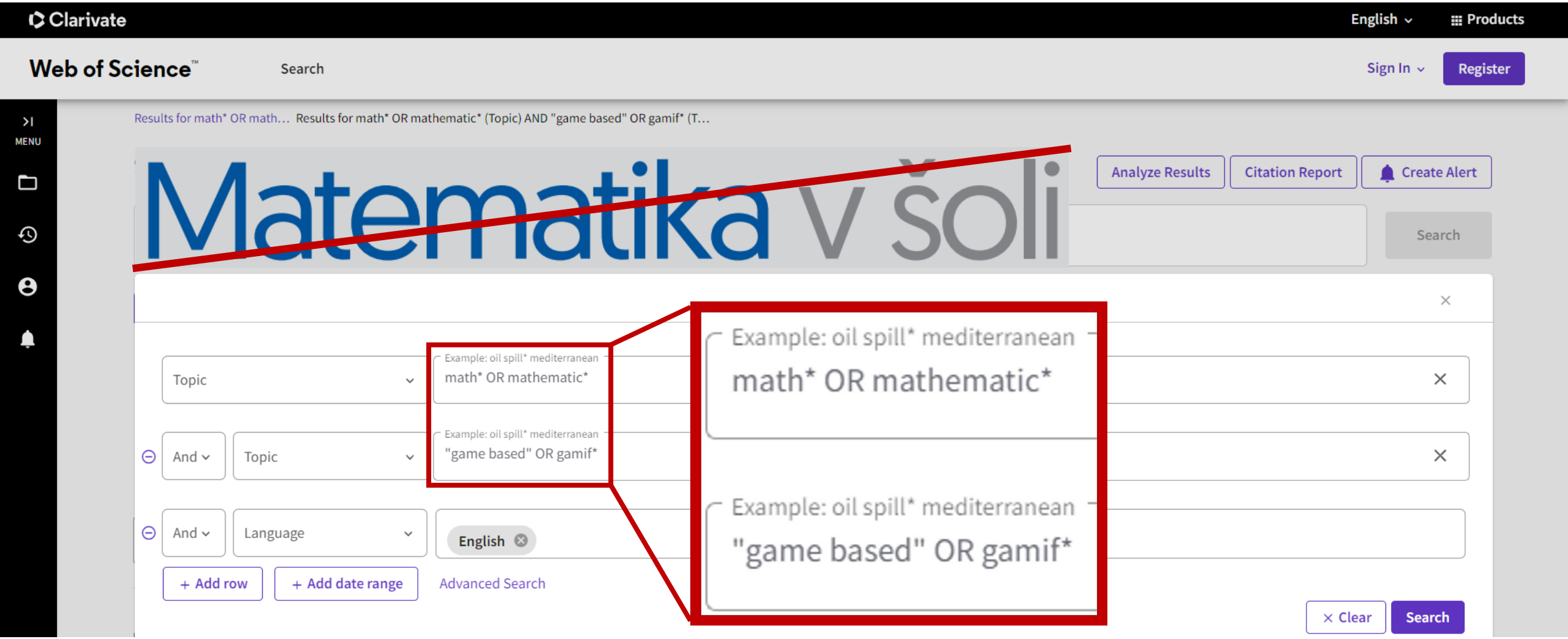

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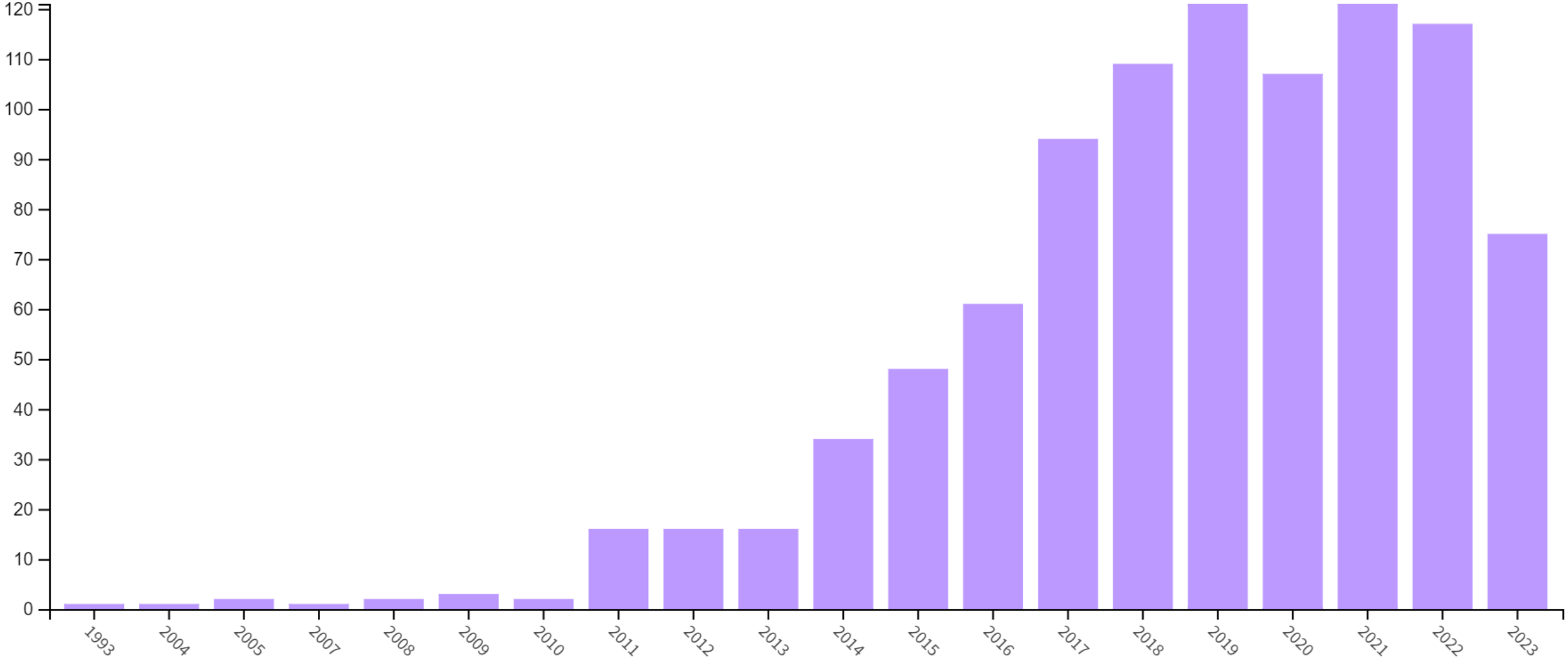

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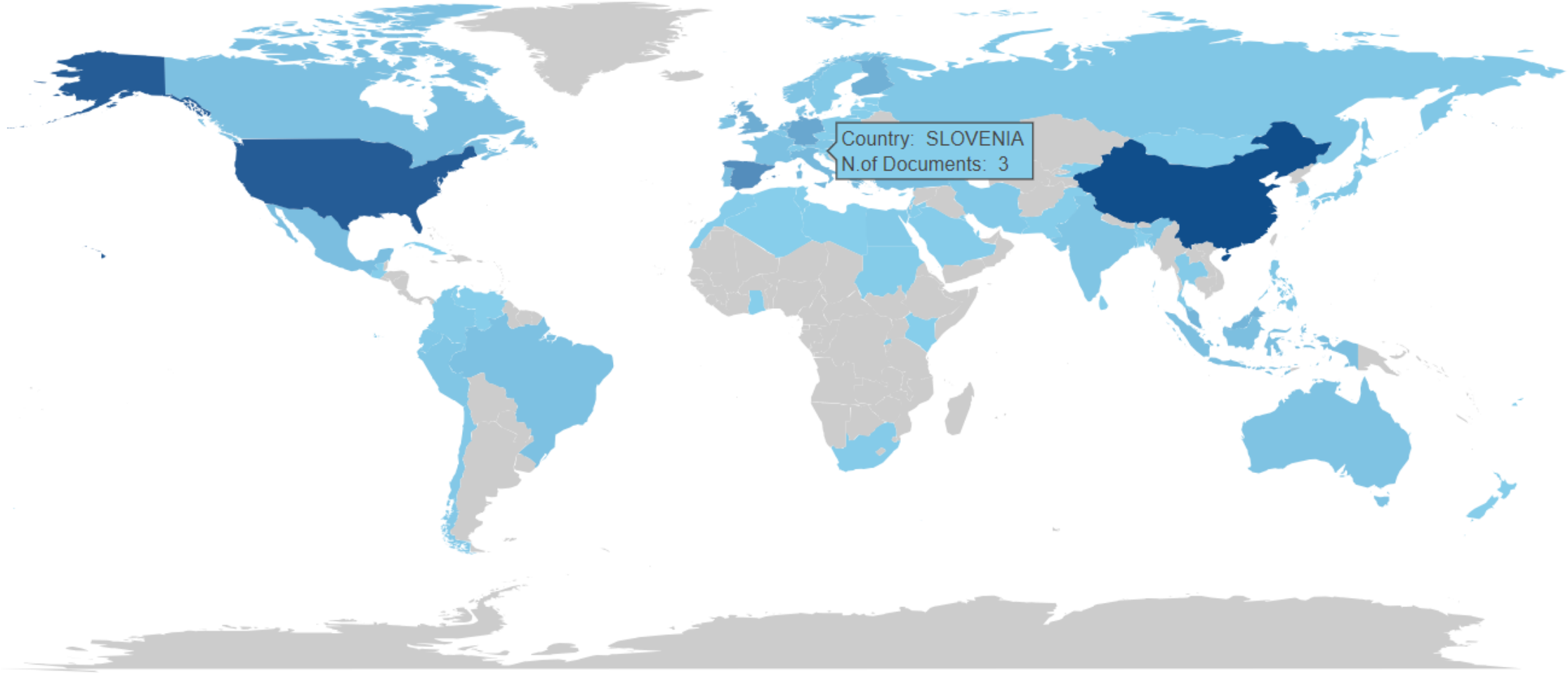

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Daniel Dziob[1,2] · Urszula Górska[1,3,4] · Tomasz Kołodziej[1] · Mojca Čepič[5]

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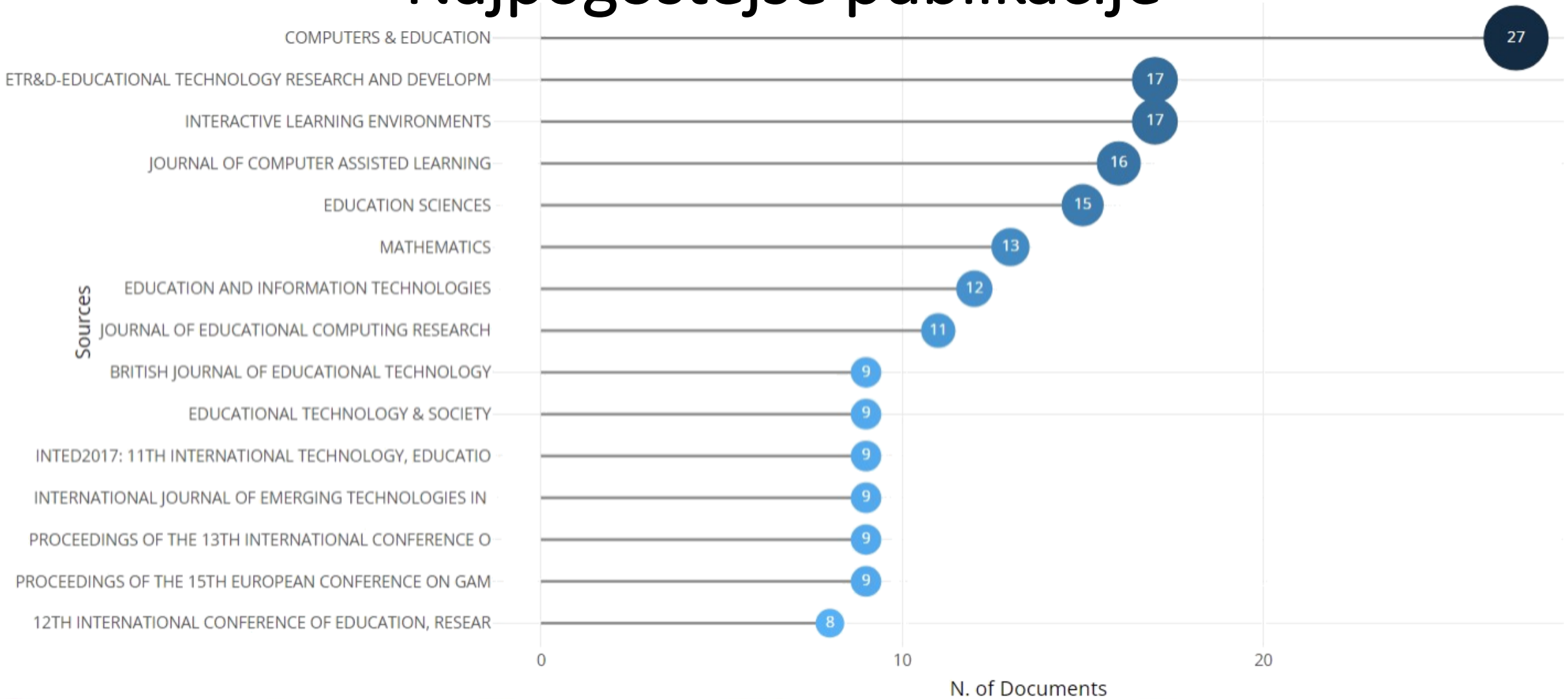

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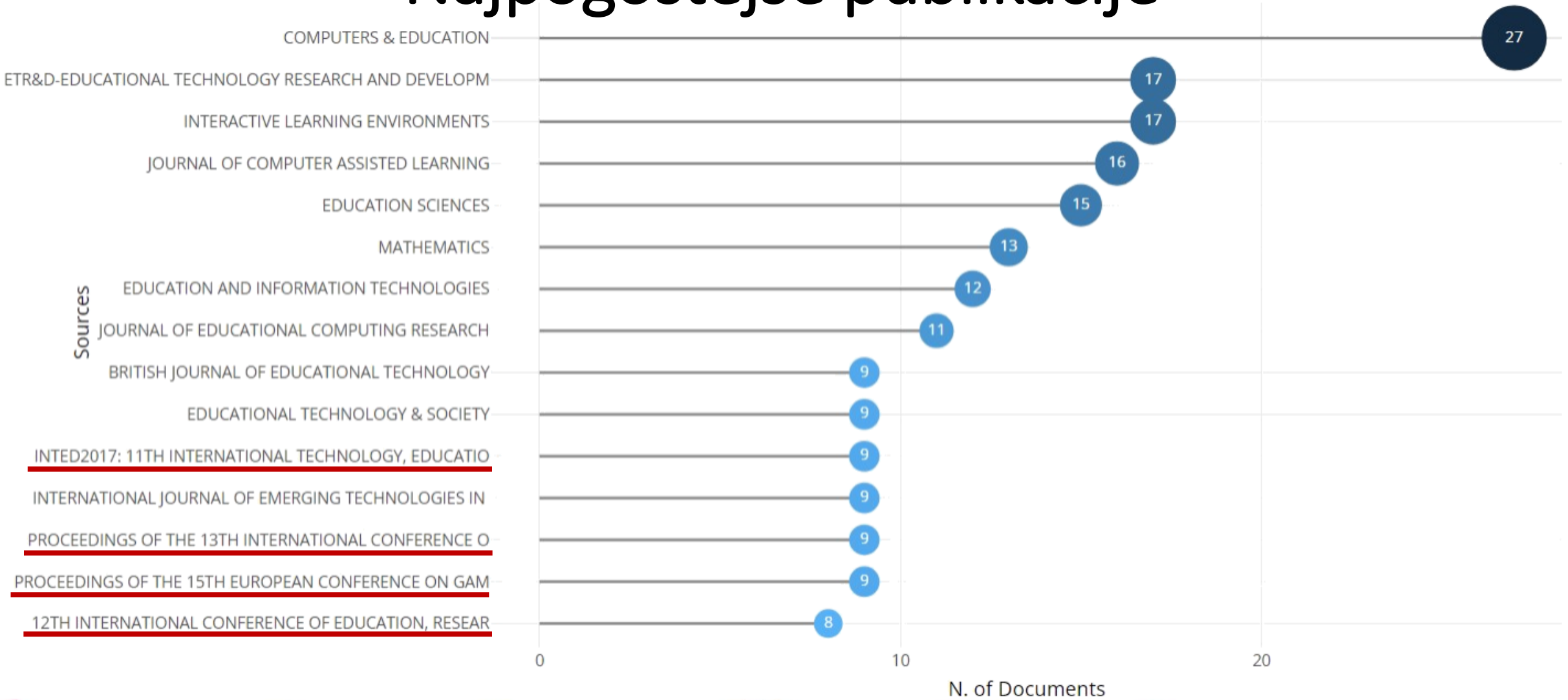

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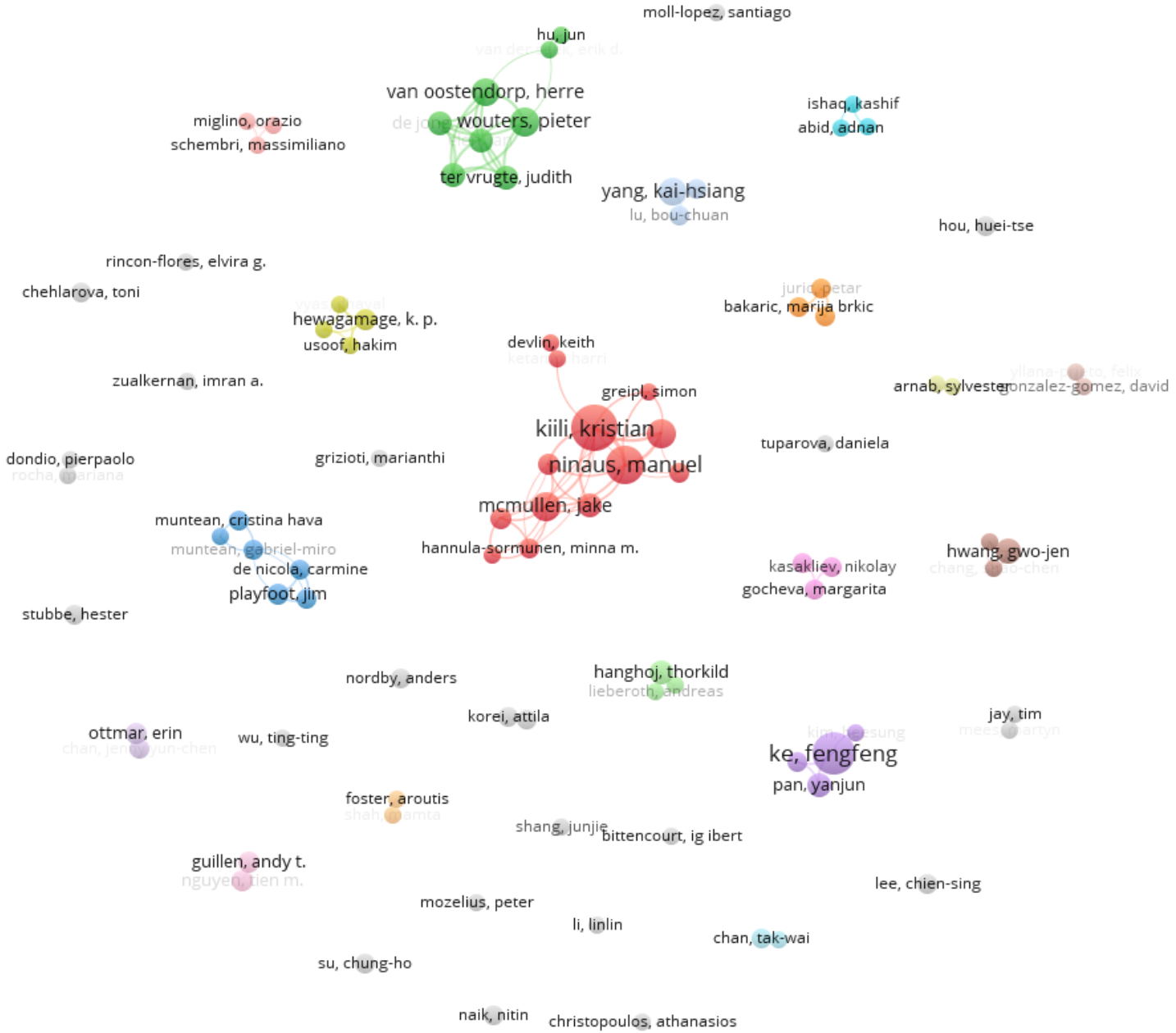

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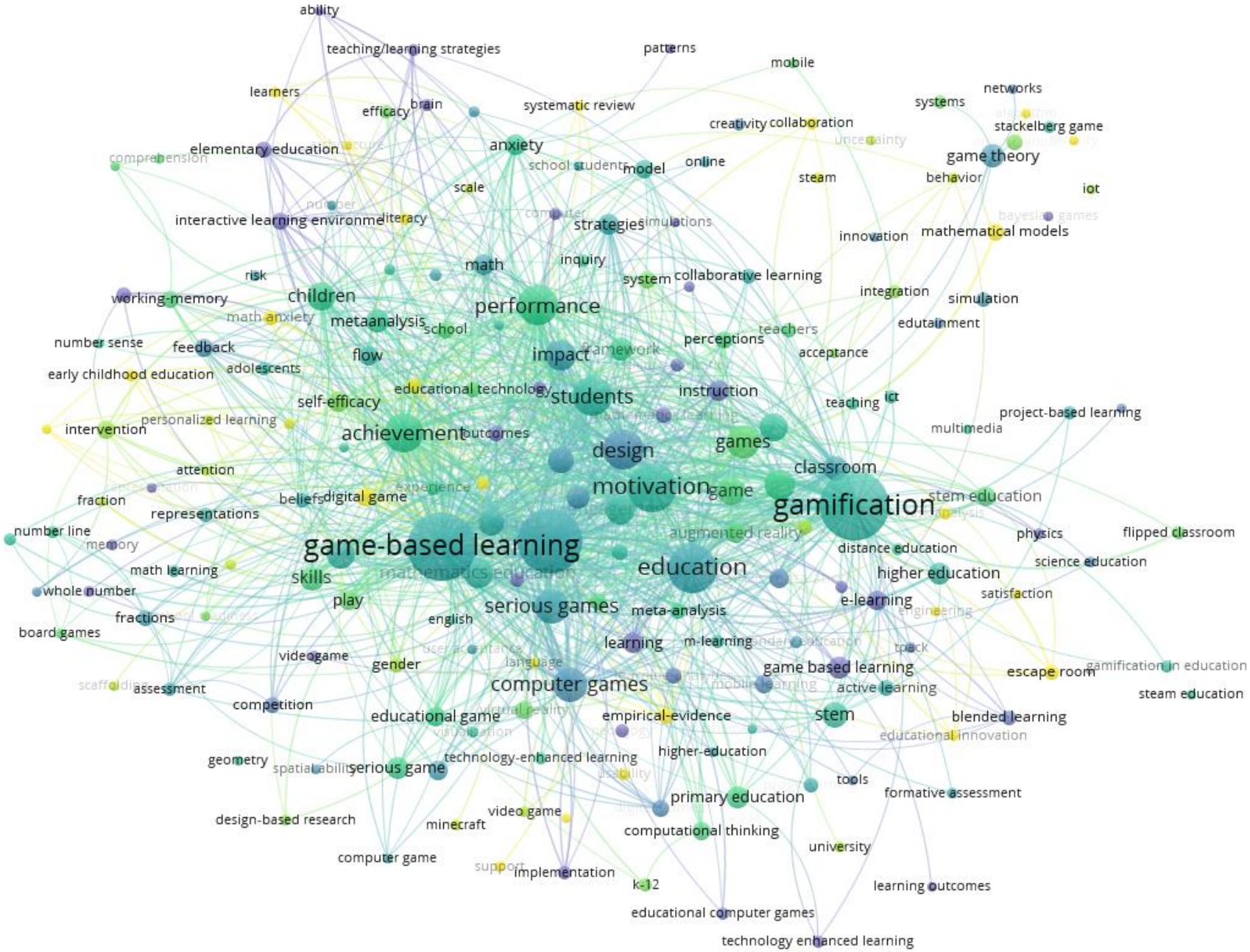

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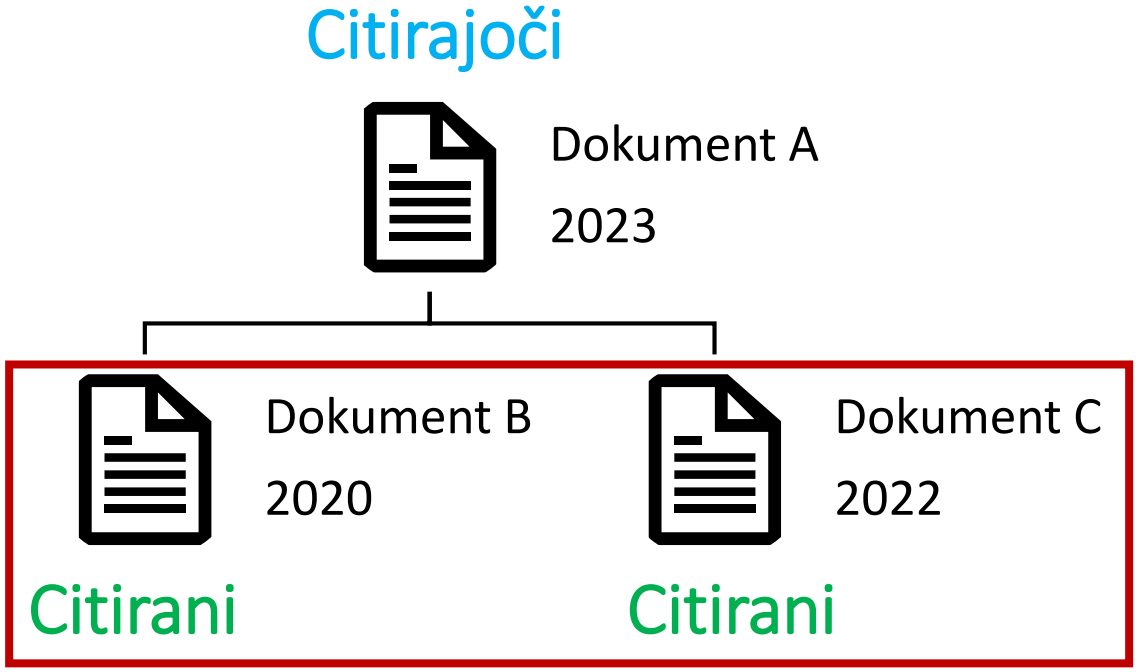

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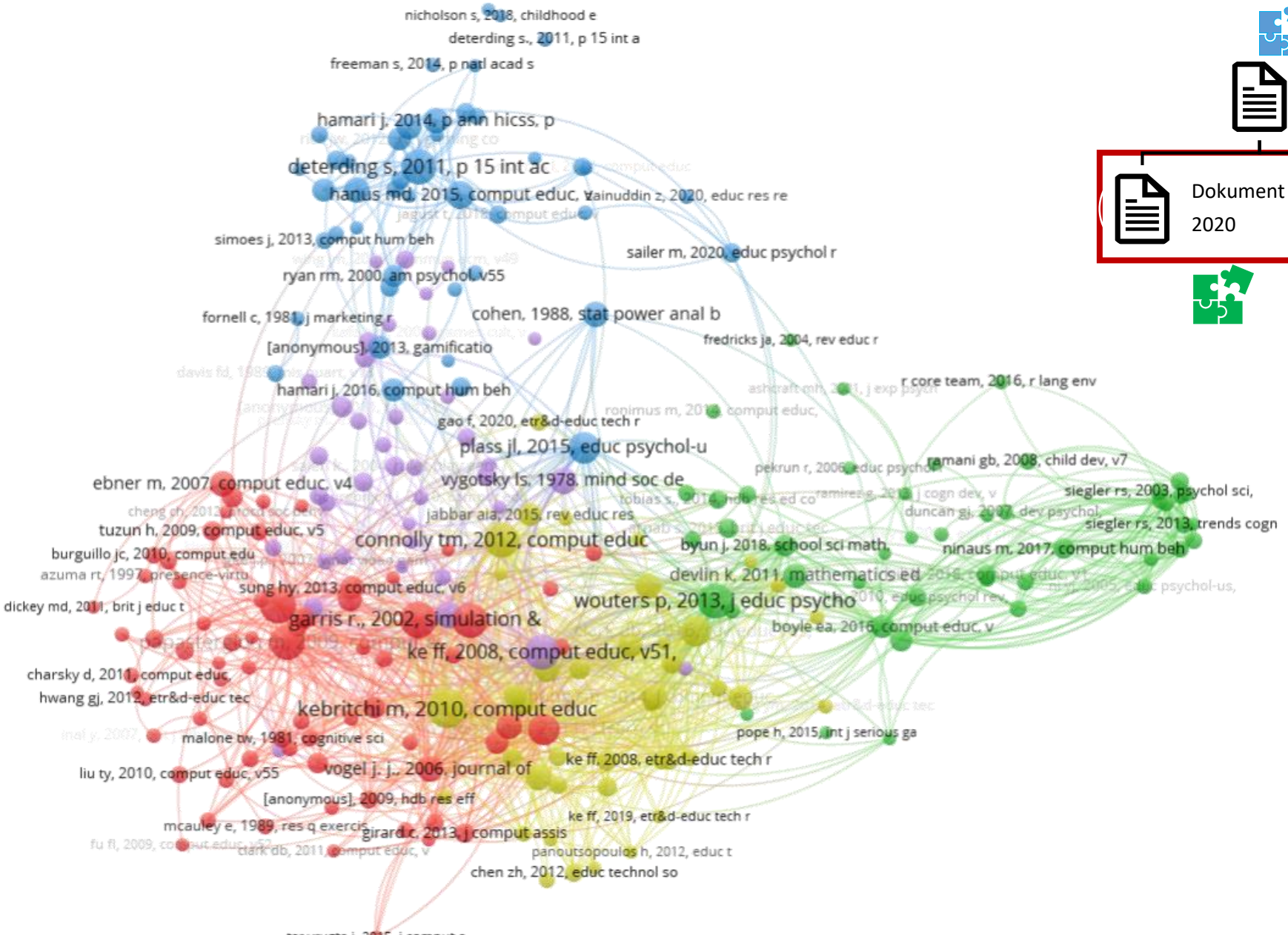

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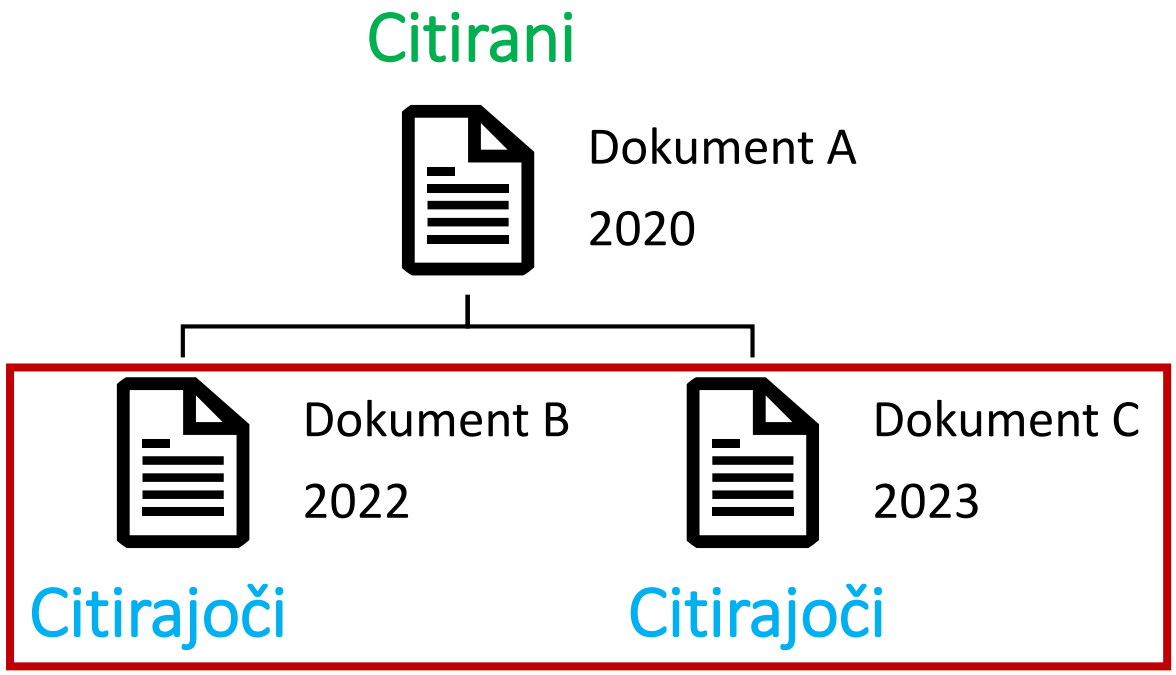

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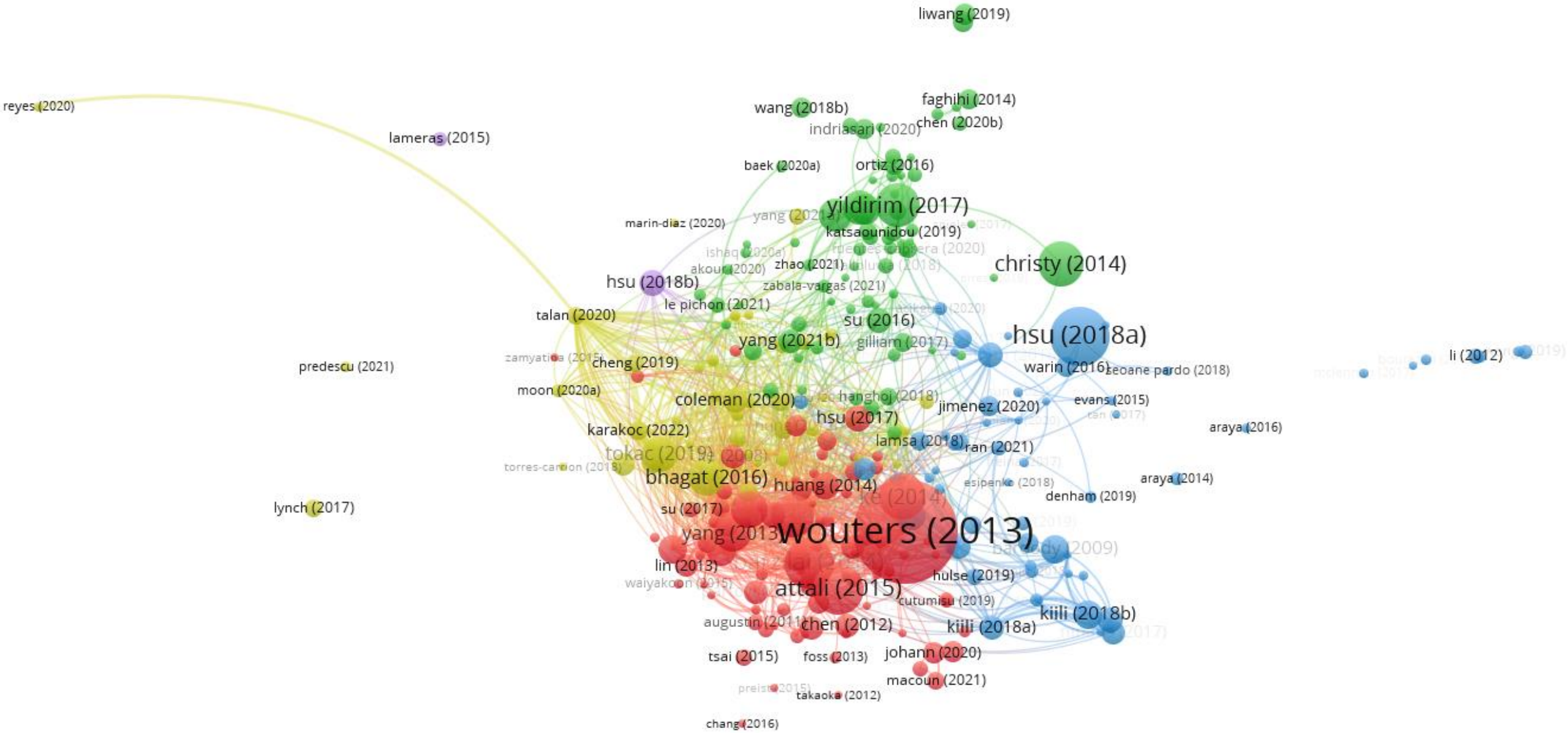

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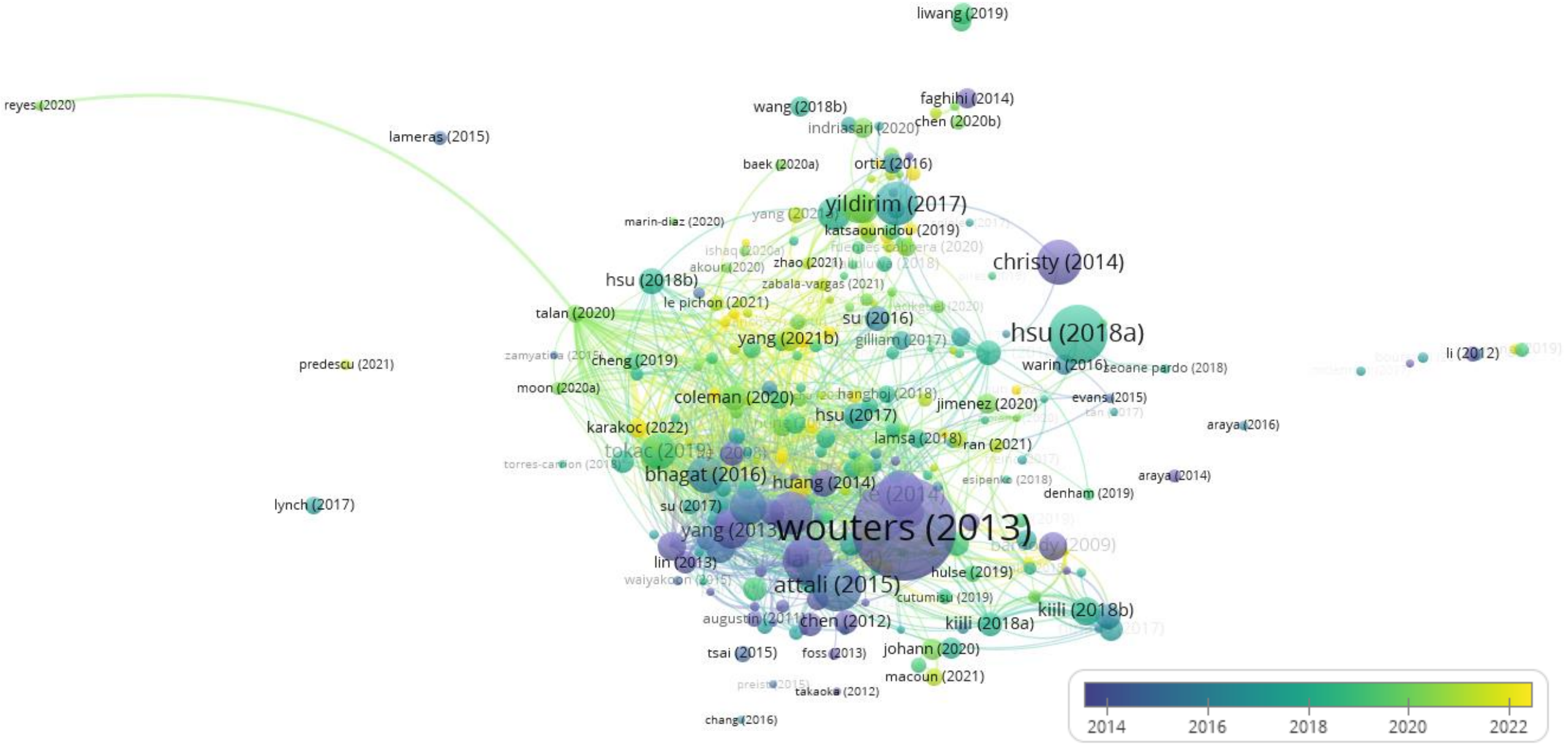

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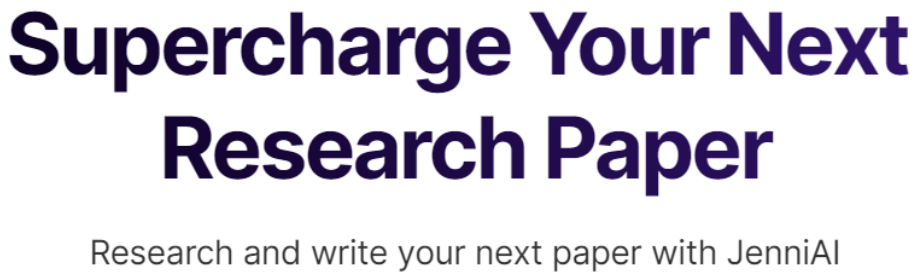

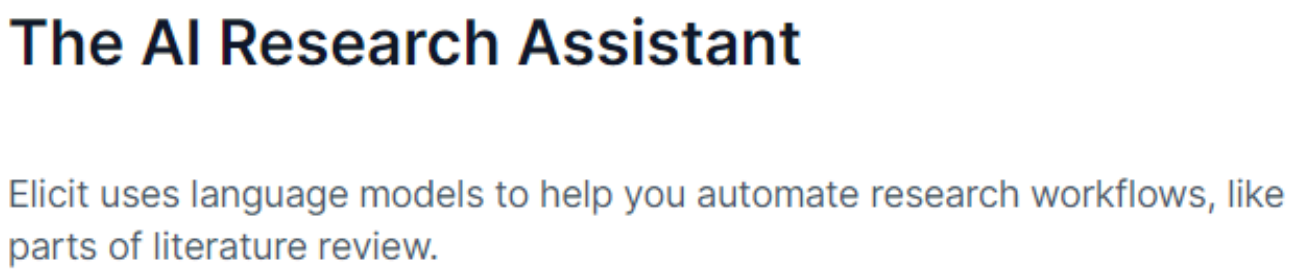

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