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Exploratory Degree of Interest: a visual interest-based exploration of multilayer networks

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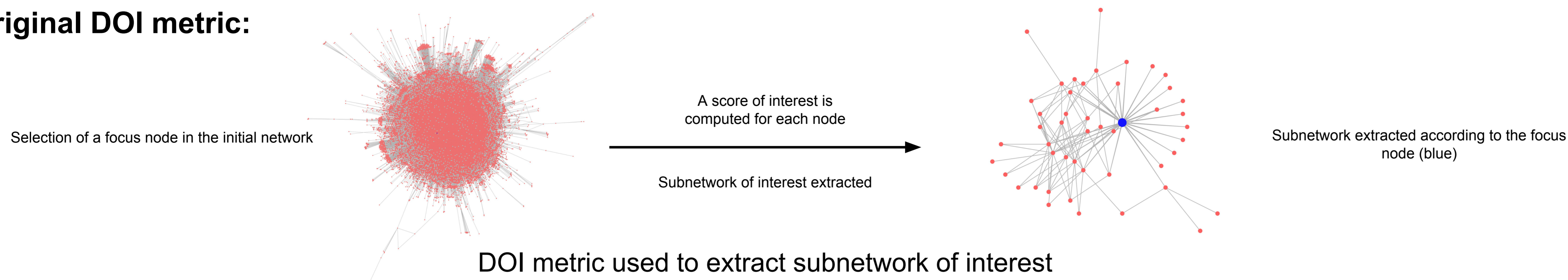
eDOI: Exploratory Degree of Interest

A Visual Interest-Based Exploration of Multilayer Networks

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How to efficiently exploring and navigating within a large multilayer network?

Original DOI metric:



$$DOI(x|y,z) = \alpha \cdot API(x) + \beta \cdot UI(x,z) + \gamma \cdot D(x,y)$$

x = node currently analysed
 y = focus node (a user preselected node)
 z = a query capturing the user's goal

User Interest - domain-dependent score according to user goal or interest for a topic

A precalculated **A Priori** score - mostly according to topological information

Distance function - the closer node x and focus node y are, the higher the score

From F. Van Ham and A. Perer. "search, show context, expand on demand": Supporting large graph exploration with degree-of-interest. *IEEE TVCG*, 15(6):953-960, 2009.

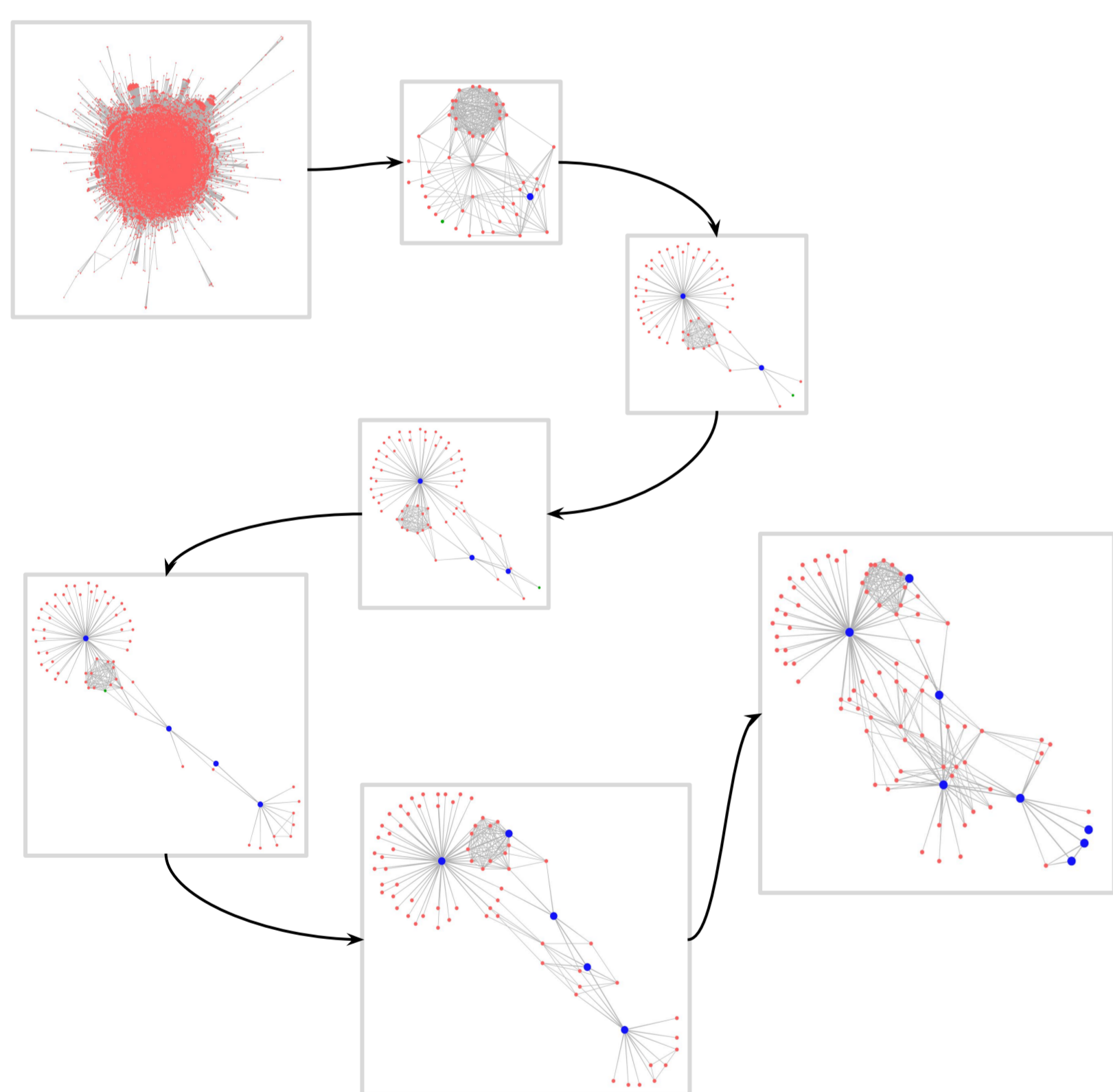
Extended approach:

Exploration of the network with a sequence of subnetworks of interest

eDOI

Two New Aspects

Multilayer networks can be explored with full control and management of layers



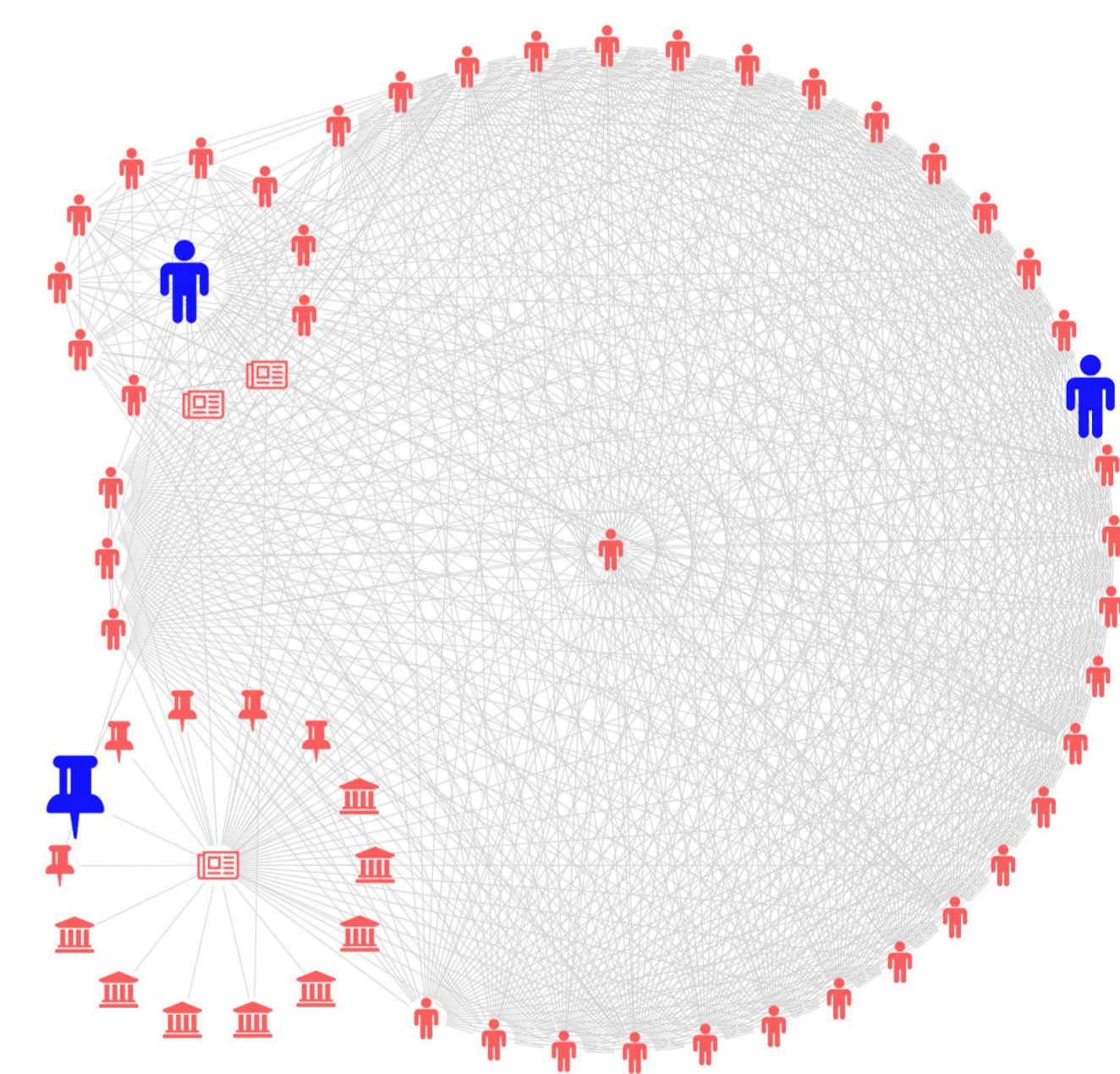
User explores the network iteratively extracting subnetwork **with increasing interest**.

A single focus node y is replaced by a **focus set Y** (blue nodes). In each subnetwork, the user promotes new nodes and add them to the focus set Y.

New subnetworks are created according to the changing focus set Y. At each iteration, the user gathers increasingly relevant semantic information.

The **search strategy can be layer dependent**. The eDOI further processes the queries on each layer accordingly.

- Person
- Resource
- Institution
- Topic



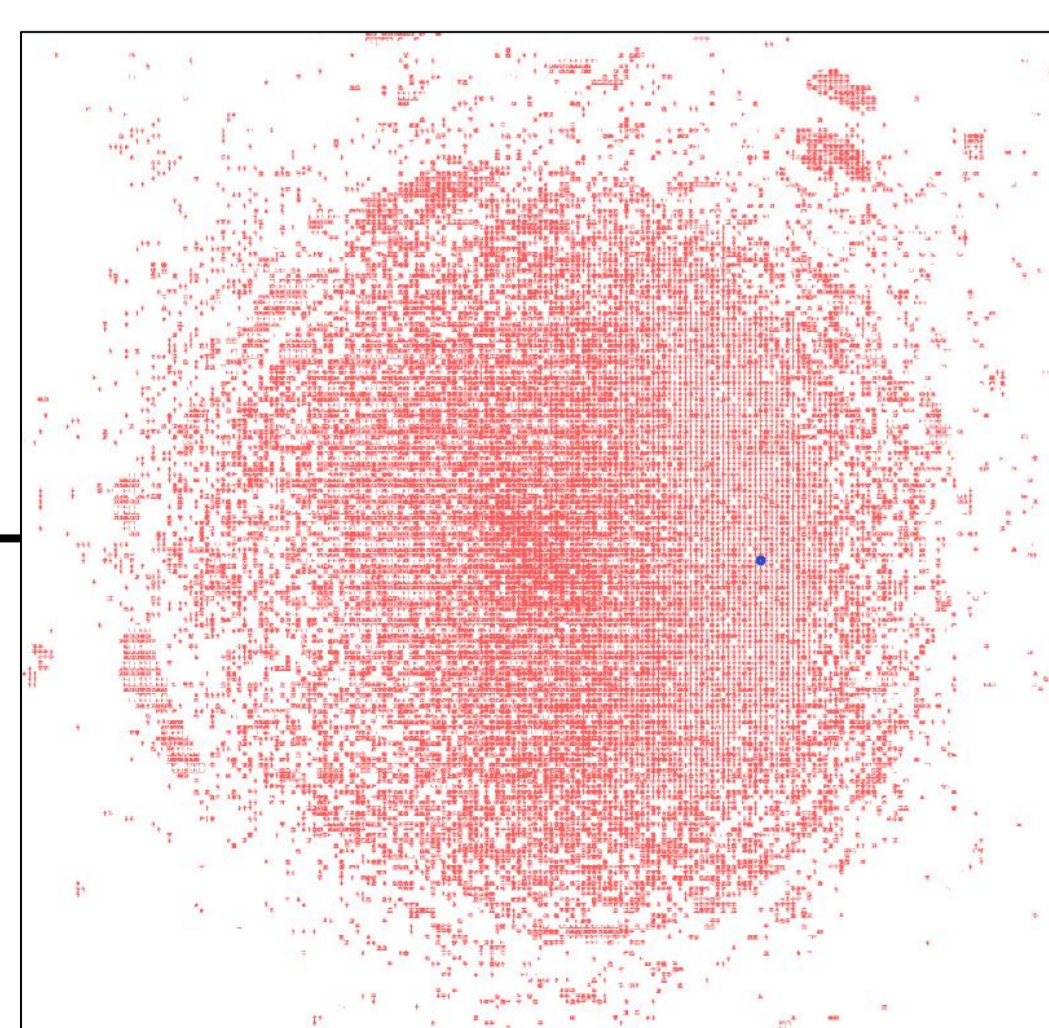
$$DOI(x|Y,z,L) = \alpha \cdot API(x) + \beta \cdot UI(x,z(Y,L(x))) + \gamma \cdot D(x,Y)$$

Nodes in the focus set Y are semantically meaningful (w.r.t the search). They are used to compute user interest UI. Each focus node impacts future computations of the UI function.

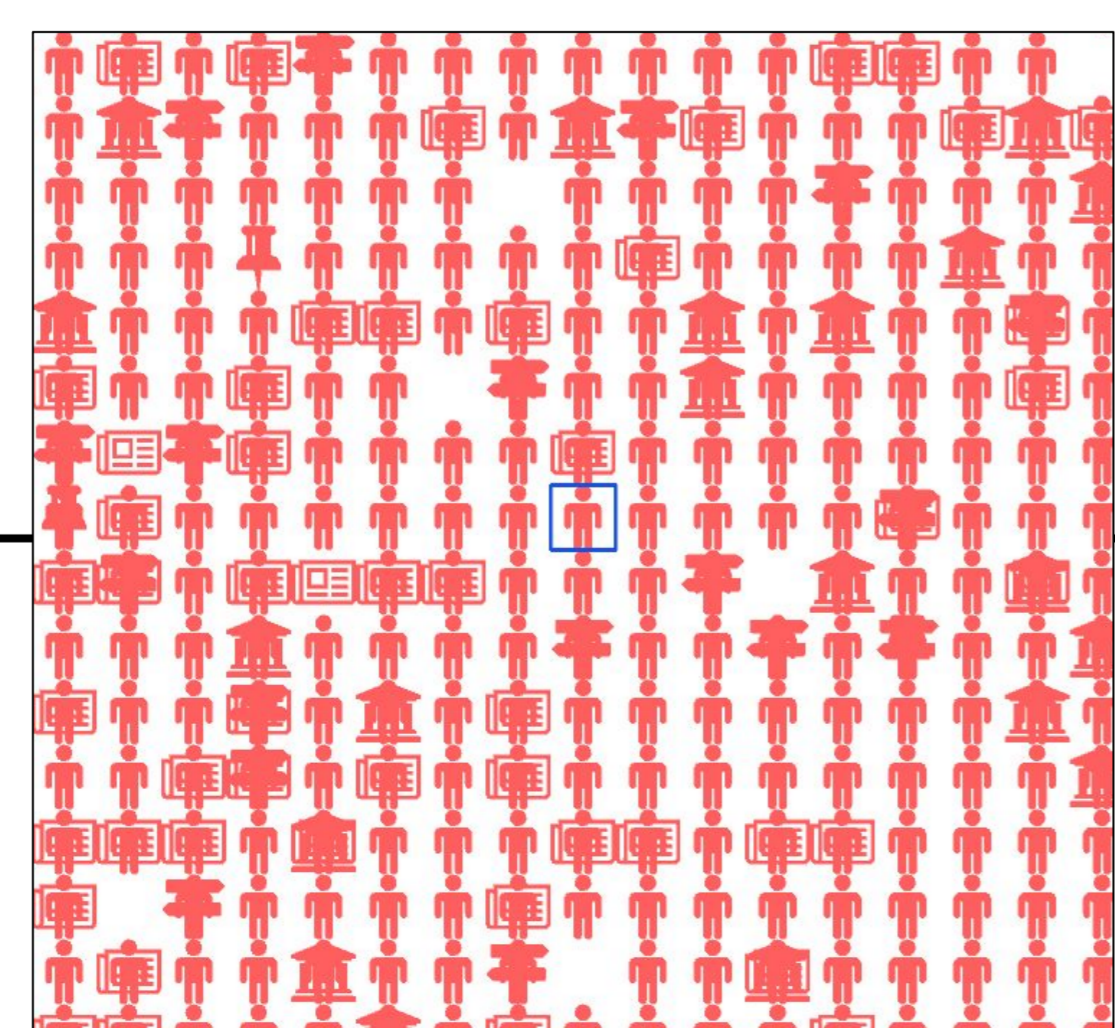
L(x) represents the layers containing node x. The query z may vary on each layer in order to comply with the user's search strategy.

Distance function D computes a centroid C on x and the focus set Y. Nodes in the focal zone induced from C get selected with higher probability.

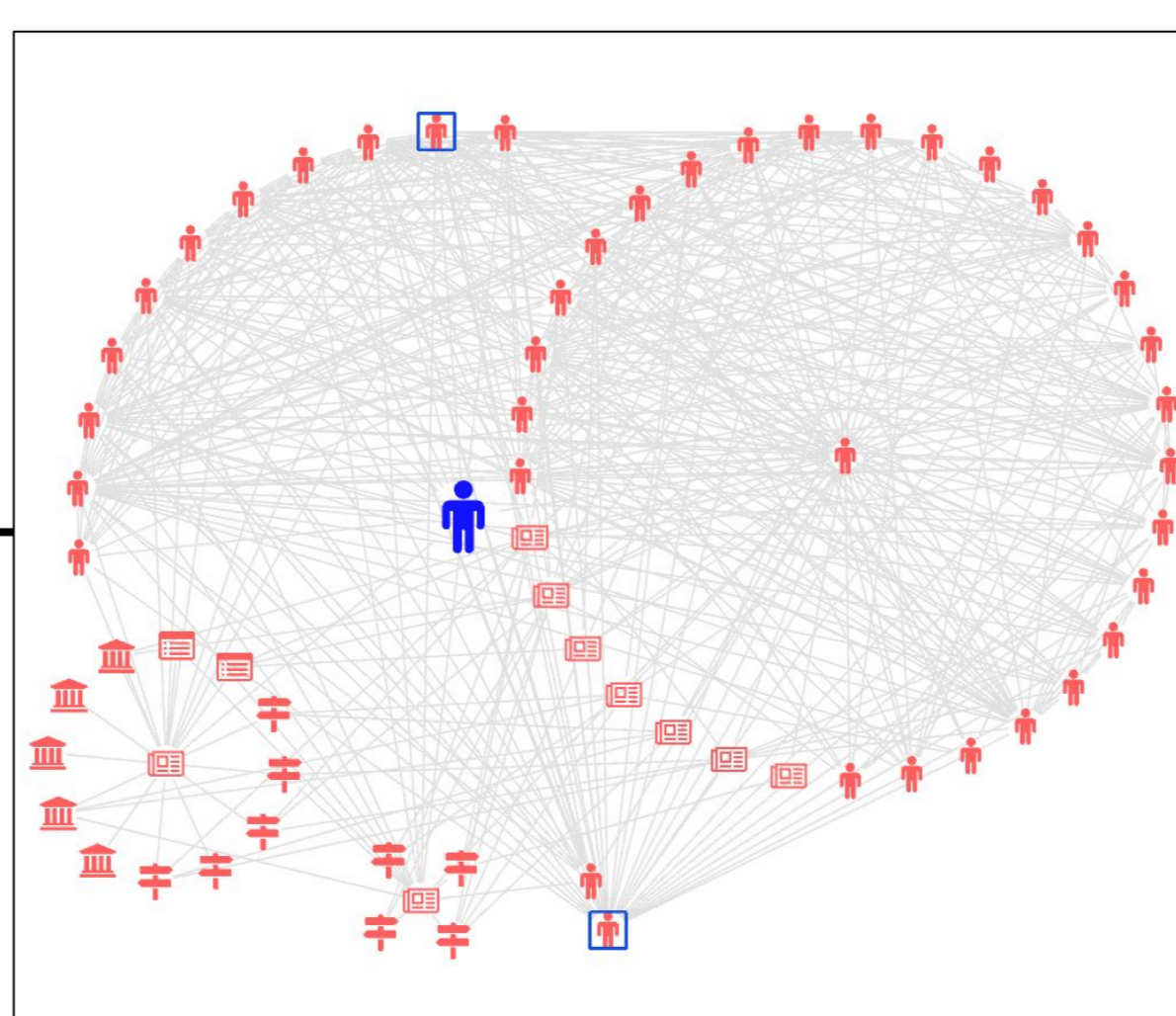
Use case: Digital Cultural Heritage - EU construction and relations with the rest of the world



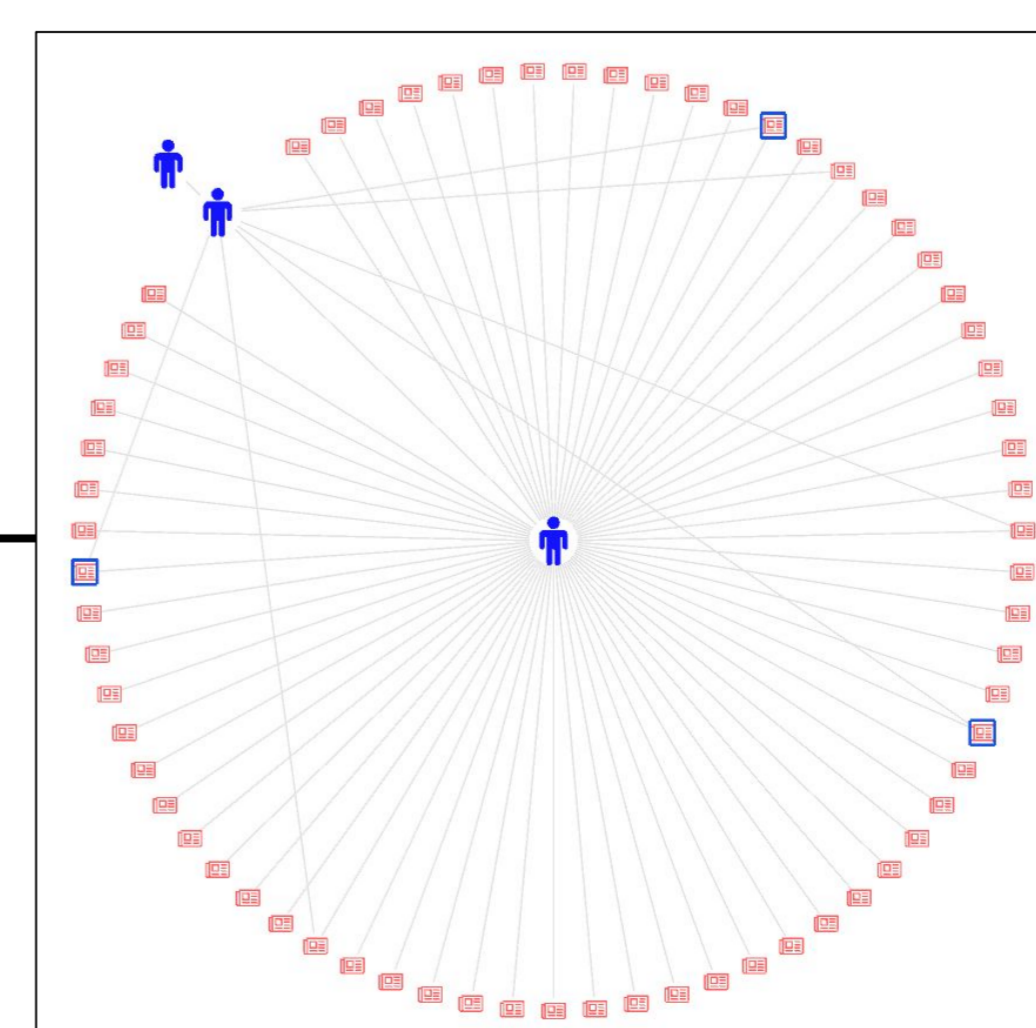
Find documents about relations between USA and France



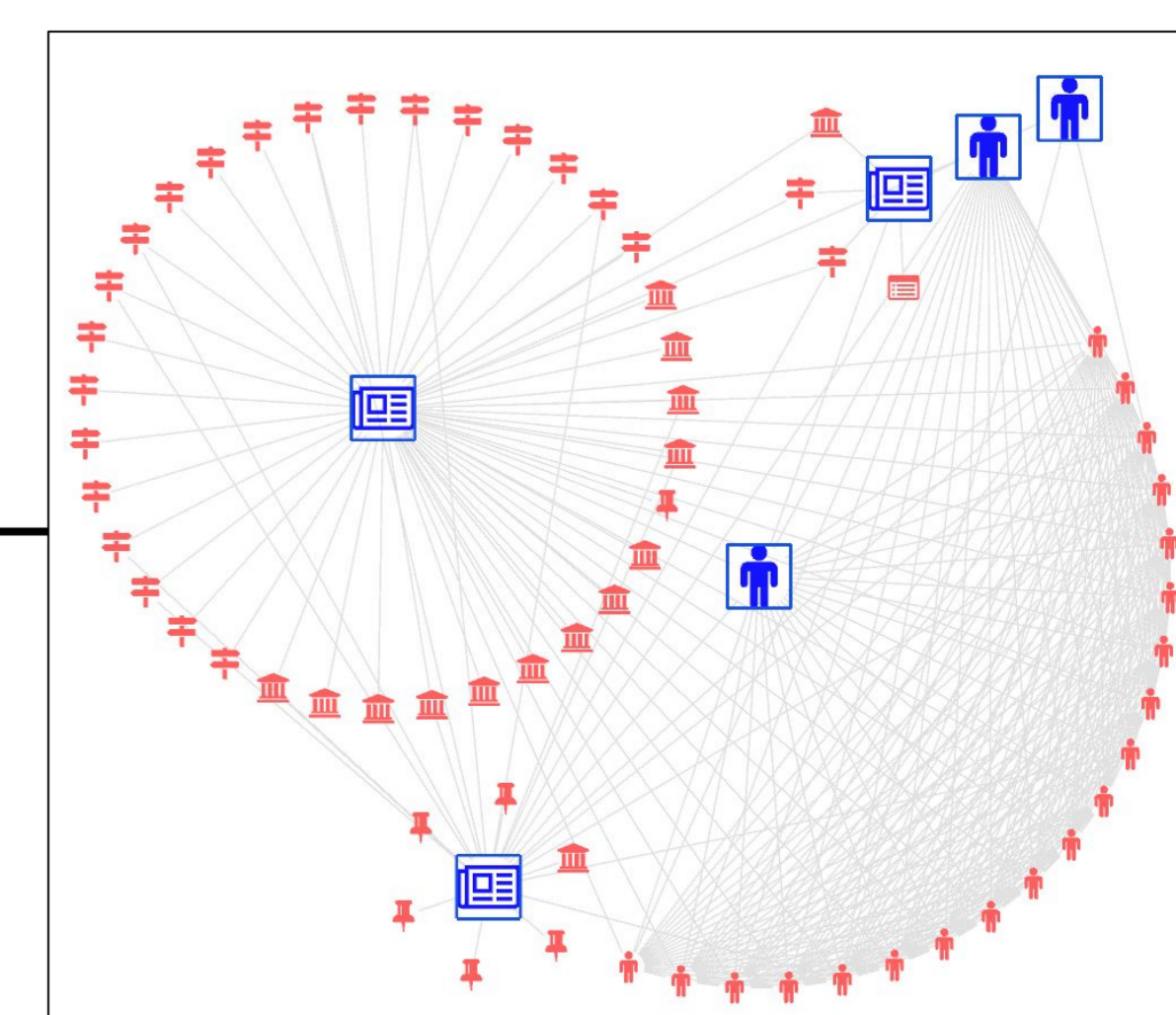
First, George Bush is selected to create a new subnetwork.



Then, two french presidents are also selected by the user. They bring new semantic information for creating a new subnetwork



The new subnetwork shows a lot of documents relative to G.Bush and the French presidents.



Selecting these elements creates a new more relevant subnetwork. This iterative process is repeated until a satisfying network is found.