

# Explainability of LRoleSim

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## 1 Correctness and validity of algorithms

To prove the correctness and validity of our algorithm, we created a small graph dataset that is called **HanamiSpots** and then performed our algorithm and the algorithm RoleSim on this graph dataset. We extracted all the nodes of Hanami spots in Japan from DBpedia (English version) and ranked them in ascending order based on the number of references from other nodes to them using SPARQL query language.

From the result outputted from this SPARQL code, we chose the first four nodes “Kamagatani”, “Hinokinai\_River\_Embankment”, “Tamagawadai\_Park”, and “Sakurayama” that have the smallest number of references from other nodes. We utilized the above four nodes and all of their immediate neighbor nodes to create a small graph dataset that is called **HanamiSpots** and illustrated in **Figure 1** to demonstrate the correctness and validity of our algorithm. Among the edges in the original graph, edges between nodes, which appear in the graph dataset **HanamiSpots**, were also added to **HanamiSpots**. In this way, the small graph dataset **HanamiSpots** was constructed. The resulting small graph dataset **HanamiSpots** has 13 nodes, 15 edges, and 6 edge labels. For the graph **HanamiSpots**, we computed the node similarity between the node “Kamagatani” and any node in the remaining nodes using the label similarity functions  $L_d$ ,  $L_e$ ,  $L_{ed}$ , and  $L_{edt}$ .

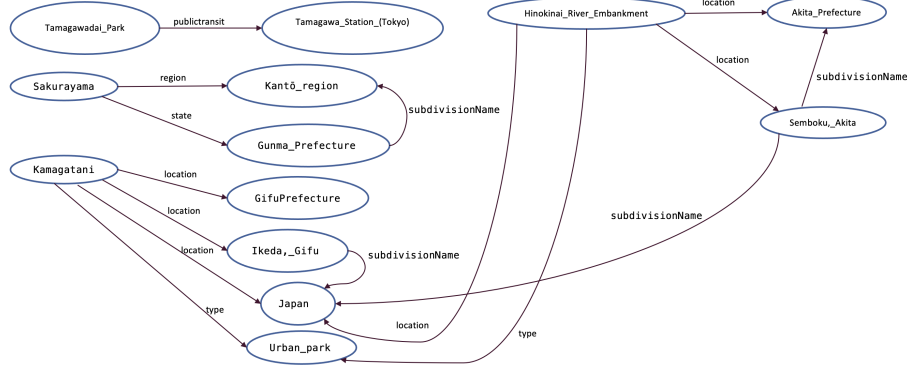


Figure 1: Small graph dataset **HanamiSpots**

Table 1: Experiment on the small graph dataset **HanamiSpots**: Similarity of node “Kamagatani” and all the remaining nodes

Similarity after one iteration					
Rank	RoleSim	LRoleSim.l	LRoleSim.e	LRoleSim.ed	LRoleSim.ed_EntityType
0	Hinokinal_River_Embankment, 1.000	Hinokinal_River_Embankment, 1.000	Hinokinal_River_Embankment, 1.000	Hinokinal_River_Embankment, 1.000	Kamagatani, 1.000
1	Japan, 1.000	Kamagatani, 1.000	Kamagatani, 1.000	Kamagatani, 1.000	Hinokinal_River_Embankment, 0.600
2	Kamagatani, 1.000	Sakurayama, 0.600	Japan, 0.600	Urban_park, 0.200	Urban_park, 0.200
3	Semboku_Akita, 0.800	Semboku_Akita, 0.600	Urban_park, 0.400	Akita_Prefecture, 0.200	Akita_Prefecture, 0.200
4	Urban_park, 0.600	Gunma_Prefecture, 0.400	Akita_Prefecture, 0.400	Kantō_region, 0.200	Kantō_region, 0.200
5	Akita_Prefecture, 0.600	Tamagawadai_Park, 0.400	GifuPrefecture, 0.400	Gunma_Prefecture, 0.200	Gunma_Prefecture, 0.200
6	Kantō_region, 0.600	Ibetsu_Gifu, 0.400	Ibetsu_Gifu, 0.400	Tamagawadai_Park, 0.200	Tamagawadai_Park, 0.200
7	Gunma_Prefecture, 0.600	Urban_park, 0.200	Semboku_Akita, 0.400	Sakurayama, 0.200	Sakurayama, 0.200
8	Sakurayama, 0.600	Akita_Prefecture, 0.200	Kantō_region, 0.200	GifuPrefecture, 0.200	GifuPrefecture, 0.200
9	Ibetsu_Gifu, 0.600	Kantō_region, 0.200	Gunma_Prefecture, 0.200	Ibetsu_Gifu, 0.200	Ibetsu_Gifu, 0.200
10	Tamagawadai_Park, 0.400	GifuPrefecture, 0.200	Tamagawadai_Park, 0.200	Japan, 0.200	Japan, 0.200
11	GifuPrefecture, 0.400	Japan, 0.200	Sakurayama, 0.200	Semboku_Akita, 0.2	Semboku_Akita, 0.200
12	Tamagawa_Station_(Tokyo), 0.400	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200
Similarity after two iterations					
Rank	RoleSim	LRoleSim.l	LRoleSim.e	LRoleSim.ed	LRoleSim.ed_EntityType
0	Kamagatani, 1.000	Kamagatani, 1.000	Kamagatani, 1.000	Kamagatani, 1.000	Kamagatani, 1.000
1	Hinokinal_River_Embankment, 0.893	Hinokinal_River_Embankment, 0.867	Hinokinal_River_Embankment, 0.893	Hinokinal_River_Embankment, 0.867	Hinokinal_River_Embankment, 0.600
2	Japan, 0.827	Sakurayama, 0.600	Japan, 0.400	Urban_park, 0.200	Urban_park, 0.200
3	Semboku_Akita, 0.720	Semboku_Akita, 0.600	Akita_Prefecture, 0.320	Akita_Prefecture, 0.200	Akita_Prefecture, 0.200
4	Kantō_region, 0.600	Gunma_Prefecture, 0.400	GifuPrefecture, 0.320	Kantō_region, 0.200	Kantō_region, 0.200
5	Gunma_Prefecture, 0.600	Tamagawadai_Park, 0.400	Ibetsu_Gifu, 0.320	Gunma_Prefecture, 0.200	Gunma_Prefecture, 0.200
6	Sakurayama, 0.600	Ibetsu_Gifu, 0.400	Semboku_Akita, 0.320	Tamagawadai_Park, 0.200	Tamagawadai_Park, 0.200
7	Akita_Prefecture, 0.547	Urban_park, 0.200	Urban_park, 0.280	Sakurayama, 0.200	Sakurayama, 0.200
8	Urban_park, 0.520	Akita_Prefecture, 0.200	Kantō_region, 0.200	GifuPrefecture, 0.200	GifuPrefecture, 0.200
9	Ibetsu_Gifu, 0.520	Kantō_region, 0.200	Gunma_Prefecture, 0.200	Ibetsu_Gifu, 0.200	Ibetsu_Gifu, 0.200
10	Tamagawadai_Park, 0.400	GifuPrefecture, 0.200	Tamagawadai_Park, 0.200	Japan, 0.200	Japan, 0.200
11	GifuPrefecture, 0.400	Japan, 0.200	Sakurayama, 0.200	Semboku_Akita, 0.200	Semboku_Akita, 0.200
12	Tamagawa_Station_(Tokyo), 0.400	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200
Final similarity					
Rank	RoleSim	LRoleSim.l	LRoleSim.e	LRoleSim.ed	LRoleSim.ed_EntityType
0	Kamagatani, 1.000	Kamagatani, 1.000	Kamagatani, 1.000	Kamagatani, 1.000	Kamagatani, 1.000
1	Hinokinal_River_Embankment, 0.877	Hinokinal_River_Embankment, 0.867	Hinokinal_River_Embankment, 0.877	Hinokinal_River_Embankment, 0.867	Hinokinal_River_Embankment, 0.600
2	Japan, 0.811	Semboku_Akita, 0.568	Japan, 0.344	Urban_park, 0.200	Urban_park, 0.200
3	Semboku_Akita, 0.696	Sakurayama, 0.456	Akita_Prefecture, 0.280	Akita_Prefecture, 0.200	Akita_Prefecture, 0.200
4	Akita_Prefecture, 0.531	Ibetsu_Gifu, 0.400	GifuPrefecture, 0.280	Kantō_region, 0.200	Kantō_region, 0.200
5	Ibetsu_Gifu, 0.504	Gunma_Prefecture, 0.320	Ibetsu_Gifu, 0.280	Gunma_Prefecture, 0.200	Gunma_Prefecture, 0.200
6	Urban_park, 0.488	Tamagawadai_Park, 0.304	Semboku_Akita, 0.280	Tamagawadai_Park, 0.200	Tamagawadai_Park, 0.200
7	Kantō_region, 0.472	Urban_park, 0.200	Urban_park, 0.256	Sakurayama, 0.200	Sakurayama, 0.200
8	Gunma_Prefecture, 0.472	Akita_Prefecture, 0.200	Kantō_region, 0.200	GifuPrefecture, 0.200	GifuPrefecture, 0.200
9	Sakurayama, 0.472	Kantō_region, 0.200	Gunma_Prefecture, 0.200	Ibetsu_Gifu, 0.200	Ibetsu_Gifu, 0.200
10	GifuPrefecture, 0.365	GifuPrefecture, 0.200	Tamagawadai_Park, 0.200	Japan, 0.200	Japan, 0.200
11	Tamagawadai_Park, 0.304	Japan, 0.200	Sakurayama, 0.200	Semboku_Akita, 0.200	Semboku_Akita, 0.200
12	Tamagawa_Station_(Tokyo), 0.304	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200	Tamagawa_Station_(Tokyo), 0.200