

Knowledge map creation and maintenance for virtual communities of practice

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Abstract

This paper proposes a knowledge map management system to facilitate **knowledge management** in virtual communities of practice. To realize the proposed knowledge map management, we develop knowledge map creation and maintenance functions by utilizing information retrieval and data mining techniques. The knowledge maps created respectively from the documents of the teachers' professional community, SCTNet, and the thesis repository at Taiwan's National Central **Library**, are evaluated by experts of these two domains. Knowledge maps generated by the system are accepted by domain experts from the evaluation since the degree of their modification of the automatically created knowledge maps is proportionally small. The knowledge structure representing the categories of community documents maintains its high purity, diversity, specificity, and structure adaptation by using the knowledge map maintenance function with limited computational cost. Thus, the knowledge map creation and maintenance mechanisms developed in this research enable the dynamic **knowledge management** of communities of practice on the Internet.

Keywords: Knowledge map; Information retrieval; Clustering; Community of practice; Professional community

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Table 1.
Interpretation of Silhouette Coefficient ([Kaufman and Rousseeuw, 1990](#))

Silhouette Coefficient	Interpretation
0.71–1.00	A strong structure has been found
0.51–0.70	A reasonable structure has been found
0.26–0.50	The structure is weak and could be artificial; please try additional methods on this data set
0.26	No substantial structure has been found

Table 2.
Precision/recall of NSD document set

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Average
Wide	0.90/0.91	0.85/0.85	0.91/0.91	0.90/0.92	0.93/0.93	0.95/0.94	0.92/0.92	0.92/0.92	0.91/0.91
Deep	0.86/0.88	0.91/0.88	0.91/0.93	0.97/0.97	0.96/0.97	0.98/0.98	0.91/0.92	0.92/0.91	0.93/0.93
Mix	0.95/0.95	0.91/0.88	0.89/0.91	0.98/0.98	0.98/0.98	1.00/1.00	0.91/0.91	0.93/0.91	0.95/0.94

Table 3.
Precision/recall of TAIM document set

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Average
Wide	0.94/0.94	0.95/0.95	0.94/0.95	0.95/0.95	0.96/0.96	0.94/0.94	0.89/0.88	0.91/0.91	0.93/0.93
Deep	0.92/0.92	0.93/0.93	0.94/0.94	0.93/0.93	0.97/0.97	0.88/0.97	0.87/0.87	0.87/0.87	0.91/0.91

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Average
	2	3	4	4	6	1	7	8	2
Mix	0.95/0.9 6	0.97/0.9 7	0.90/0.9 1	0.98/0.9 8	0.96/0.9 4	0.90/0.8 9	0.82/0.8 2	0.92/0.9 1	0.93/0.9 2

Table 4.

Evaluation results of incremental knowledge map maintenance for NSD and TAIM document sets

	Purity	Diversity	Specificity	SAI	# of re-clustering
NSD ($\alpha = 0.84, \beta = -10\%$)	65%	74%	81%	55	4/85 (16/254) ^a
TAIM ($\alpha = 0.84, \beta = -10\%$)	75%	72%	88%	39	2/94 (13/281)

^a 4/85(16/254) means that four times of re-clustering occur out of 85 document insertions, and 16 out of 254 documents on average are re-categorized.

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