知识图谱中的实体摘要
——基于神经网络的方法

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普通青年：南昌@Wikipedia

南昌市 [编辑]

维基百科，自由的百科全书

“**南昌**”重定向至此。关于其他用法，请见“**南昌 (消歧义)**”。

南昌市（普通话：Nánchāng shì，赣语白话字：lan^{31}chɔŋ^{11} si^{32}），简称**洪**、**昌**，古称**豫章**、**洪州**、**隆兴**、**钟陵**，别称“天下英雄城”，是中华人民共和国江西省省会，位于江西省北部偏北。市境北临九江市，西界宜春市，南达抚州市，东接上饶市。地处豫章平原腹地，东南部地势平坦，西北部为丘陵。赣江、抚河纵贯市境中部，往北注入鄱阳湖。境内湖泊众多，有青岚湖、军山湖、金溪湖、瑶湖、南塘湖等。全市总面积7,195平方公里，人口537.14万，市人民政府驻红谷滩区。南昌是国家历史文化名城，建城史逾二千二百年，有海昏侯墓、滕王阁、八大山人纪念馆等名胜古迹，亦为鄱阳湖生态经济区核心城市、全国性综合交通枢纽、航空工业基地和光电产业基地。

目录 [隐藏]

文艺青年：南昌@DBpedia

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@prefix dbr:    <http://dbpedia.org/resource/> .
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文艺青年（知识图谱）也需要实体摘要

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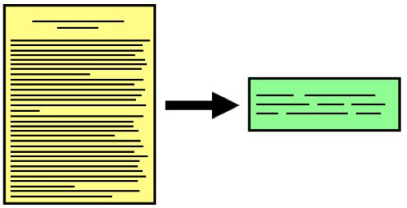

南昌市 [编辑]

维基百科，自由的百科全书

"南昌"重定向至此。关于其他用法，请见"南昌 (消歧义)"。

南昌市（普通话：Nánchāng shì，赣语白话字：lan^{31}chon^{11} si^{32}），简称**洪、昌**，古称**豫章、洪州、隆兴、钟陵**，别称"天下英雄城"，是中华人民共和国江西省省会，位于江西省北部偏北。市境北临九江市，西界宜春市，南达抚州市，东接上饶市。地处豫章平原腹地，东南部地势平坦，西北部为丘陵。赣江、抚河纵贯市境中部，往北注入鄱阳湖。境内湖泊众多，有青岚湖、军山湖、金溪湖、瑶湖、南塘湖等。全市总面积7,195平方公里，人口537.14万，市人民政府驻红谷滩区。南昌是国家历史文化名城，建城史逾二千二百年，有海昏侯墓、滕王阁、八大山人纪念馆等名胜古迹，亦为鄱阳湖生态经济区核心城市、全国性综合交通枢纽、航空工业基地和光电产业基地。

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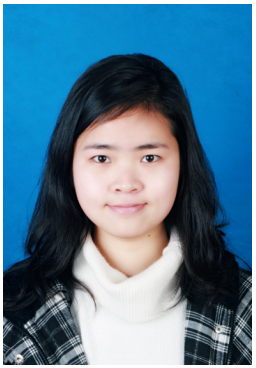
- 3.2 行政区划

4 人口
- 4.1 民族

5 交通

感谢合作者——他们才是智慧的源泉



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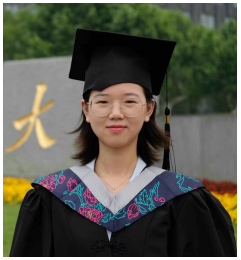
李俊宥



陈越

张文

陈华钧

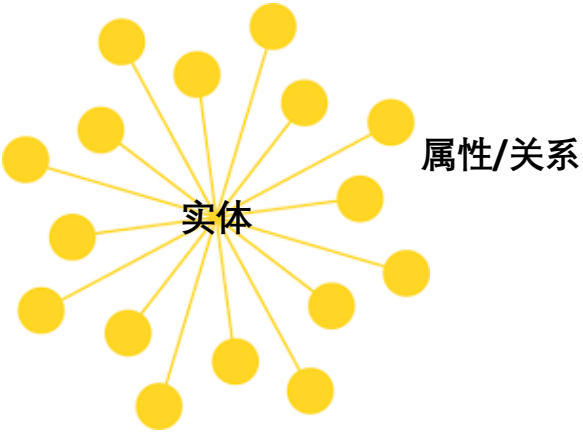
瞿裕忠

Thanh Tran

Kalpa Gunaratna

Evgeny Kharlamov

知识图谱中的实体摘要——问题提出



知识图谱中的实体摘要——问题提出

Google The Keyword Latest stories Product updates Company news

SEARCH

Introducing the Knowledge Graph: things, not strings

Amit Singhal
SVP, Engineering
Published May 16, 2012

Search is a lot about discovery—the basic human need to learn and broaden your horizons. But searching still requires a lot of hard work by you, the user. So today I'm really excited to launch the Knowledge Graph, which will help you discover new information quickly and easily.

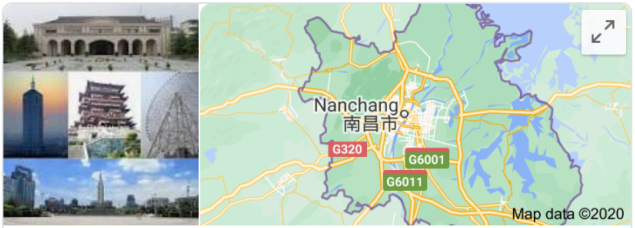
The Knowledge Graph enhances Google Search in three main ways to start:

1. Find the right thing

2. Get the best summary

With the Knowledge Graph, Google can better understand your query, so we can summarize relevant content around that topic, including key facts you're likely to need for that particular thing. For example, if you're looking for Marie Curie, you'll see when she was born and died, but you'll also get details on her education and scientific discoveries:

3. Go deeper and broader



Nanchang (南昌市)

City in China

Nanchang is the capital and largest city of Jiangxi Province, People's Republic of China. As of November 2017, the total population in Nanchang City was 5,246,600, while the built-up area made of 6 urban districts plus Nanchang county is home to more than 4,300,000 inhabitants. Wikipedia

Area: 7,194 km²

Metropolitan area: 4,588 km²

Elevation: 37 m

Weather: 23°C, Wind N at 21 km/h, 30% Humidity

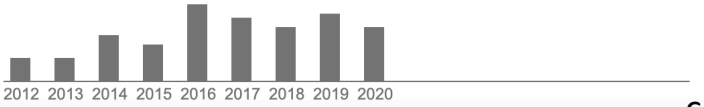
Province: Jiangxi

Local time: Sunday 1:42 pm

知识图谱中的实体摘要——问题提出

Relin: relatedness and informativeness-based centrality for entity summarization

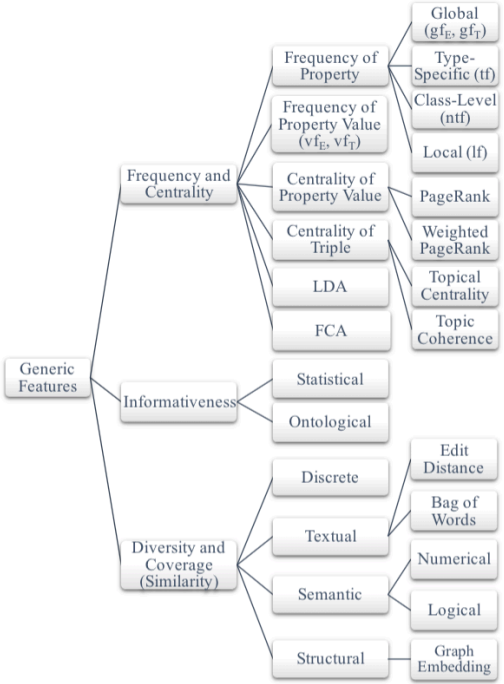
Authors	Gong Cheng, Thanh Tran, Yuzhong Qu
Publication date	2011/10/23
Conference	International Semantic Web Conference
Pages	114-129
Publisher	Springer, Berlin, Heidelberg
Description	Linked Data is developing towards a large, global repository for structured, interlinked descriptions of real-world entities. An emerging problem in many Web applications making use of data like Linked Data is how a lengthy description can be tailored to the task of quickly identifying the underlying entity. As a solution to this novel problem of entity summarization, we propose RELIN, a variant of the random surfer model that leverages the relatedness and informativeness of description elements for ranking. We present an implementation of this conceptual model, which captures the semantics of description elements based on linguistic and information theory concepts. In experiments involving real-world data sets and users, our approach outperforms the baselines, producing summaries that better match handcrafted ones and further, shown to be useful in a concrete task.
Total citations	Cited by 100



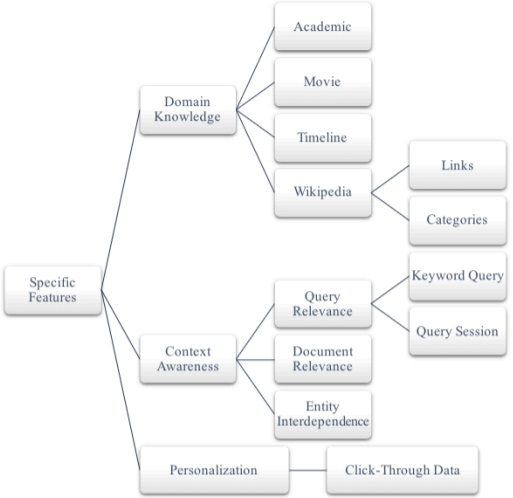
Gong Cheng, Thanh Tran, Yuzhong Qu
RELIN: Relatedness and Informativeness-Based Centrality for Entity Summarization
ISWC 2011

知识图谱中的实体摘要——现状总结

通用技术



专用技术



Qingxia Liu, Gong Cheng, Kalpa Gunaratna, Yuzhong Qu
Entity Summarization: State of the Art and Future Challenges
CoRR abs/1910.08252

知识图谱中的实体摘要——现状总结

Table 1. Entity Summarizers (Sorted by Publication Date) and Their Technical Features

	Generic Features			Specific Features
	Frequency and Centrality	Informativeness	Diversity and Coverage (Similarity)	Domains, Contexts, and Personalization
Falcons [32]			bag-of-words	query relevance
XRed [33]				entity interdependence
Zhang et al. [34]	weighted PageRank			click-through data
RELIN [18]	weighted PageRank	statistical		
Thalhammer et al. [19]		statistical		movie domain
Yovisto [35]	tf			academic domain, Wikipedia links
MMR-QSFS [36]				query relevance
DIVERSUM [37]	lf		discrete	
SUMMARUM [38]	PageRank		discrete	
FACES [21]	$\mathtt{vf}_{\mathbb{T}}$	statistical	bag-of-words	
COMB [13]	lf	statistical	edit-distance-like, numerical, logical	document relevance, entity interdependence
TimeMachine [39]				timeline domain
C3D+P [15]	lf	statistical	edit-distance-like, numerical, logical	entity interdependence
TRank^{++} [9]	$\mathtt{vf}_{\mathbb{E}}$	ontological		document relevance
FACES-E [22]	$\mathtt{vf}_{\mathbb{T}}$	statistical	bag-of-words	
CD [40]		statistical	edit-distance-like, numerical, logical	
Li et al. [23]	$\mathtt{gf}_{\mathbb{E}}$, lf			movie domain
CES [20]	weighted PageRank	statistical		session relevance
LinkSUM [24]	$\mathtt{gf}_{\mathbb{T}}$, lf, PageRank		discrete	Wikipedia links
Aemoo [41]	tf			
DynES [42]	$\mathtt{gf}_{\mathbb{E}}$, $\mathtt{gf}_{\mathbb{T}}$, ntf, $\mathtt{vf}_{\mathbb{E}}$, $\mathtt{vf}_{\mathbb{T}}$			query relevance
REMES [11]	$\mathtt{vf}_{\mathbb{E}}$	statistical	bag-of-words, structural	entity interdependence
Multi-EGS [43]	tf, ntf, $\mathtt{vf}_{\mathbb{T}}$		edit-distance-like	Wikipedia categories
ES-LDA [44]	LDA			Wikipedia categories
ES-LDA$_{ext}$ [45]	LDA			
CTab [16]	$\mathtt{gf}_{\mathbb{E}}$		bag-of-words, numerical	entity interdependence
BAFREC [46]	$\mathtt{gf}_{\mathbb{T}}$, $\mathtt{vf}_{\mathbb{T}}$	ontological	bag-of-words	
KAFCA [47]	FCA			
MPSUM [48]	LDA		discrete	Wikipedia categories
Gottschalk et al. [49]				timeline domain, Wikipedia links
VISION-KG [50]	$\mathtt{gf}_{\mathbb{E}}$, $\mathtt{gf}_{\mathbb{T}}$, ntf, $\mathtt{vf}_{\mathbb{E}}$, $\mathtt{vf}_{\mathbb{T}}$		structural	query relevance

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CoRR abs/1910.08252

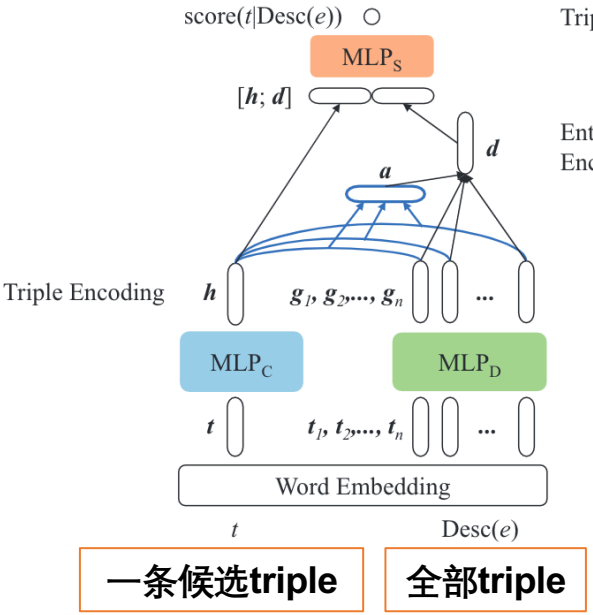
知识图谱中的实体摘要——现状总结

- Entity Summarization BenchMark (ESBM)
  - https://w3id.org/esbm/
  - 175个实体，175*6*2=2100份金标摘要

	DBpedia		LinkedMDB	
	$k = 5$	$k = 10$	$k = 5$	$k = 10$
RELIN	0.242 -○○▼▼▼▼▼▼	0.455 -▼○○▼○▼▼▼	0.203 -○○▼○▲▼○▼	0.258 -▼○▼▼○▼▼▼
DIVERSUM	0.249 ○-○○▼▼▼▼▼	0.507 ▲-▲○○○○○○	0.207 ○-○▼○▲▼○▼	0.358 ▲-▲○○▲▼○▼
FACES	0.270 ○○-○○○▼▼▼	0.428 ○▼-▼▼▼▼▼▼	0.169 ○○-▼▼○▼▼▼	0.263 ○▼-▼▼○▼▼▼
FACES-E	0.280 ▲○○-○○▼▼▼	0.488 ○○▲-○○○○○	0.313 ▲▲▲-▲▲▼▲○	0.393 ▲○▲-▲▲○○○
CD	0.283 ▲▲○○-○▼○○	0.513 ▲○▲○-○○○○	0.217 ○○▲▼-▲▼○▼	0.331 ▲○▲▼-▲▼▼▼
LinkSUM	0.287 ▲▲○○○-▼○○	0.486 ○○▲○○-○○○	0.140 ▼▼○▼▼-▼▼▼	0.279 ○▼○▼▼-▼▼▼
BAFREC	0.335 ▲▲▲▲▲▲-○○	0.503 ▲○▲○○○-○○	0.360 ▲▲▲▲▲▲-▲▲	0.402 ▲▲▲○▲▲-○○
KAFCA	0.314 ▲▲▲▲○○○-○	0.509 ▲○▲○○○○-○	0.244 ○○▲▼○▲▼-○	0.397 ▲○▲○▲▲○-○
MPSUM	0.314 ▲▲▲▲○○○○-	0.512 ▲○▲○○○○○-	0.272 ▲▲▲○▲▲▼○-	0.423 ▲▲▲○▲▲○○-
ORACLE	0.595	0.713	0.619	0.678

Qingxia Liu, Gong Cheng, Kalpa Gunaratna, Yuzhong Qu
ESBM: An Entity Summarization BenchMark
ESWC 2020 (Best Resource Paper Nominee)

DeepLENS：一种基本的神经网络方法



$$\boldsymbol{t} = [\text{Embedding}(\texttt{prop}(t));\ \text{Embedding}(\texttt{val}(t))]$$

Qingxia Liu, Gong Cheng, Yuzhong Qu
DeepLENS: Deep Learning for Entity Summarization
DL4KG 2020

DeepLENS：一种基本的神经网络方法

Table 1. Average F1 over all the test entities. Significant and insignificant differences ($p < 0.01$) between DeepLENS and each baseline are indicated by ▲ and ○, respectively.

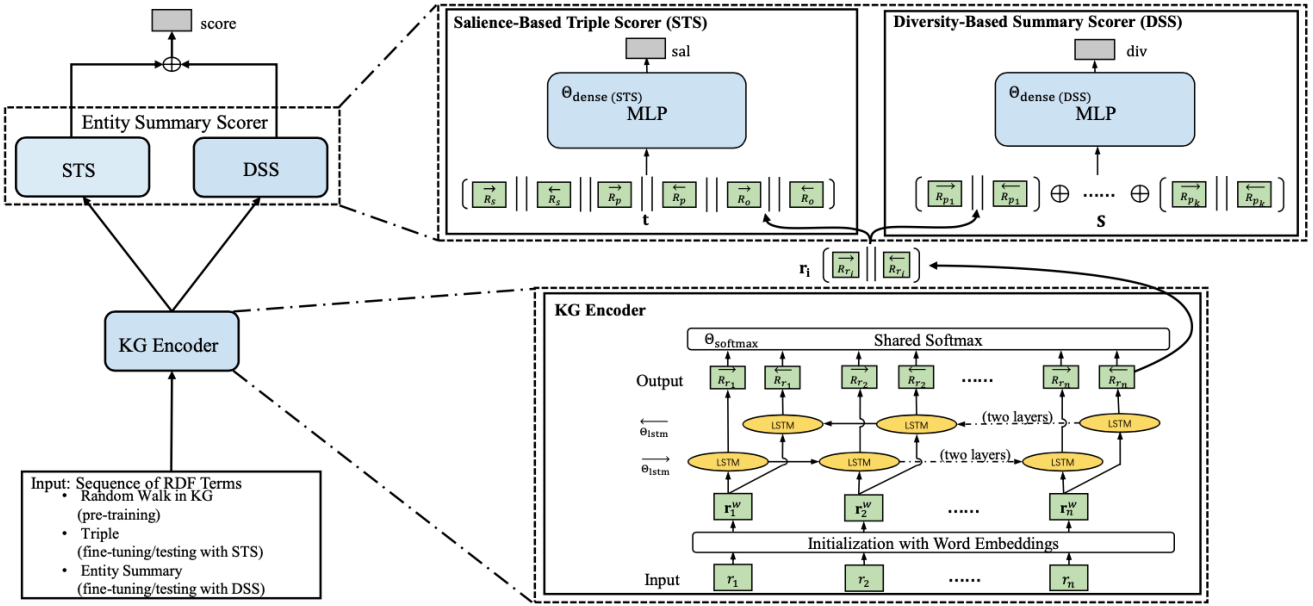
	DBpedia		LinkedMDB	
	$k = 5$	$k = 10$	$k = 5$	$k = 10$
RELIN [2]	0.242	0.455	0.203	0.258
DIVERSUM [9]	0.249	0.507	0.207	0.358
FACES [3]	0.270	0.428	0.169	0.263
FACES-E [4]	0.280	0.488	0.313	0.393
CD [13]	0.283	0.513	0.217	0.331
LinkSUM [10]	0.287	0.486	0.140	0.279
BAFREC [6]	0.335	0.503	0.360	0.402
KAFCA [5]	0.314	0.509	0.244	0.397
MPSUM [11]	0.314	0.512	0.272	0.423
ESA [12]	0.331	0.532	0.350	0.416
DeepLENS	0.404 ▲▲▲▲▲▲▲▲▲▲	0.575 ▲▲▲▲▲▲▲▲▲▲	0.469 ▲▲▲▲▲▲▲▲▲▲	0.489 ▲▲▲▲▲▲▲▲▲▲
ORACLE	0.595	0.713	0.619	0.678

Qingxia Liu, Gong Cheng, Yuzhong Qu
DeepLENS: Deep Learning for Entity Summarization
DL4KG 2020

NEST：基于联合编码和弱监督的神经网络方法

微调：弱监督（以维基百科文本摘要为金标）

微调：自训练（以启发式多样度为金标）



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Neural Entity Summarization with Joint Encoding and Weak Supervision

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NEST：基于联合编码和弱监督的神经网络方法

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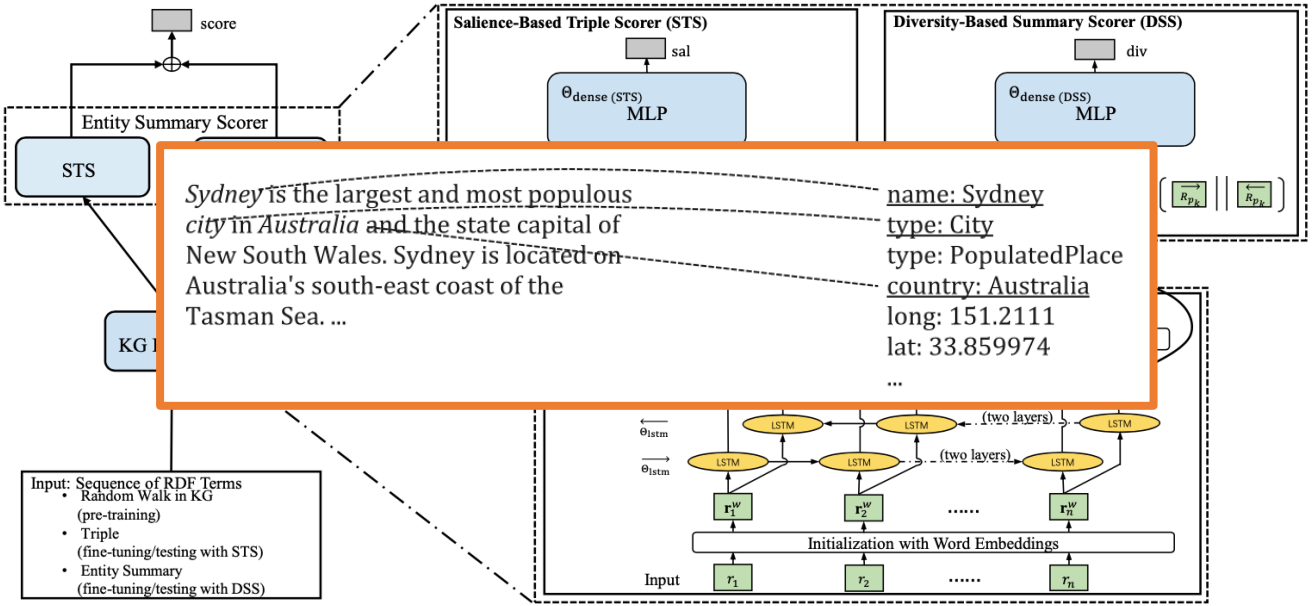

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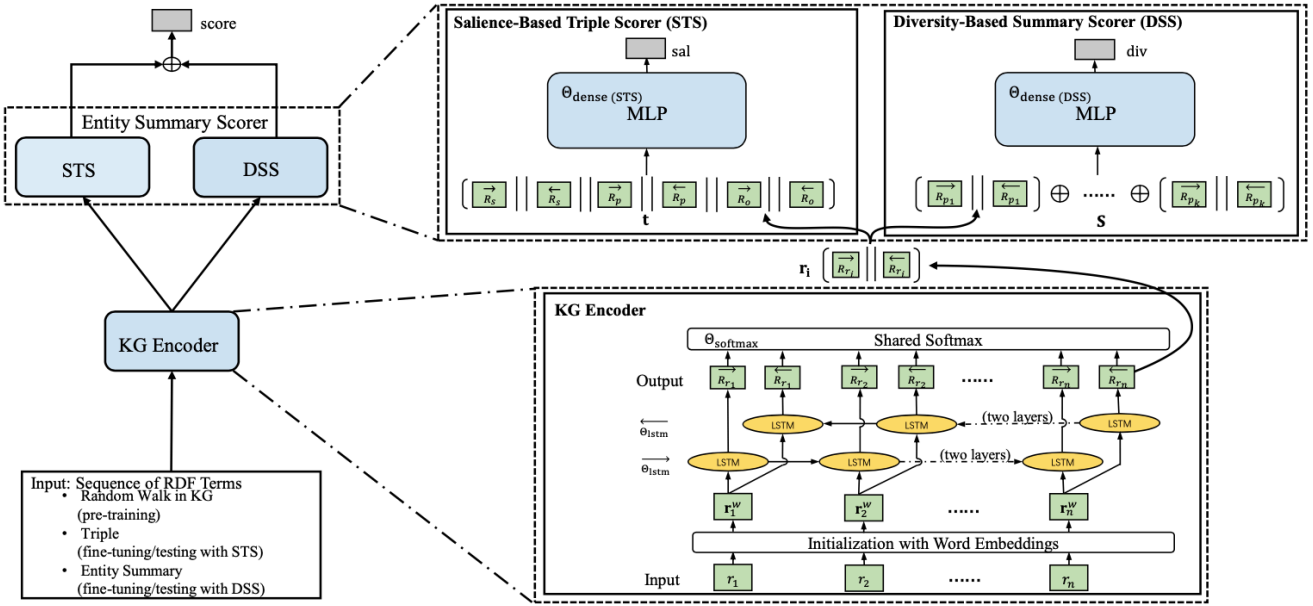

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	ESBM-D		ESBM-L		FED	
	$k=5$	$k=10$	$k=5$	$k=10$	$k=5$	$k=10$
RELIN	0.250	0.468	0.210	0.260	0.102	0.235
DIVERSUM	0.260	0.522	0.222	0.365	0.112	0.266
FACES	0.272	0.439	0.160	0.259	0.145	0.273
FACES-E	0.285	0.527	0.252	0.348	0.145	0.273
CD	0.299	0.531	0.215	0.326	0.147	0.271
LinkSUM	0.290	0.498	0.117	0.255	0.236	0.332
NEST	0.354 ▲▲▲▲▲▲	0.540 ▲△○○▲▲	0.332 ▲▲▲▲▲▲	0.465 ▲▲▲▲▲▲	0.272 ▲▲▲▲▲○	0.346 ▲▲▲▲▲○
ORACLE	0.601	0.721	0.631	0.680	0.530	0.582

Table 2: Comparison with existing methods for general-purpose entity summarization (F1). Significant improvements ($p < 0.01$ and $p < 0.05$) achieved by NEST over 6 baselines are indicated by ▲ and △, respectively. Insignificant differences are indicated by ○.

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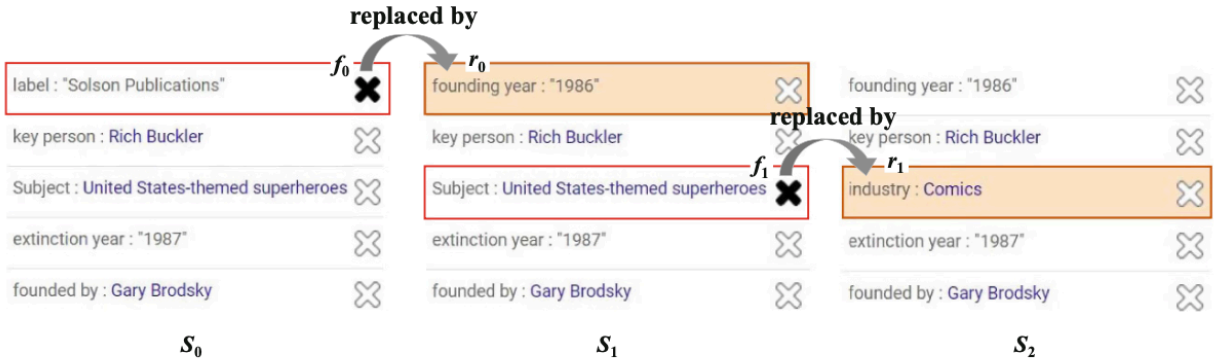
DRESSED：支持用户反馈的神经网络方法

One Summary Does Not Fit All

DRESSED：支持用户反馈的神经网络方法



MDP

$$\begin{aligned}
\text{state:} \quad & Z_i = \langle S_i, F_i, C_i, f_i \rangle, \\
\text{action:} \quad & A_i = r_i, \\
\text{policy:} \quad & \pi_{\boldsymbol{\theta}}(t|Z_i) = \frac{\exp(\texttt{score}(t|Z_i, \boldsymbol{\theta}))}{\sum_{t' \in C_i} \exp(\texttt{score}(t'|Z_i, \boldsymbol{\theta}))}, \\
\text{reward:} \quad & R_{i+1} = \rho(Z_i, A_i) = \frac{\texttt{rel}(r_i)}{\log(i+2)}, \\
\text{transition:} \quad & Z_{i+1} = \tau(Z_i, A_i) = \langle S_{i+1}, F_{i+1}, C_{i+1}, f_{i+1} \rangle, \\
\text{initialization:} \quad & Z_0 = \langle S_0, \emptyset, (\texttt{Desc}(e) \setminus S_0), f_0 \rangle.
\end{aligned}$$

- S_i：当前摘要
- F_i：早前删除的全部triple
- C_i：当前可替入的全部候选triple
- f_i：当前删除的triple
- r_i：当前替入的triple

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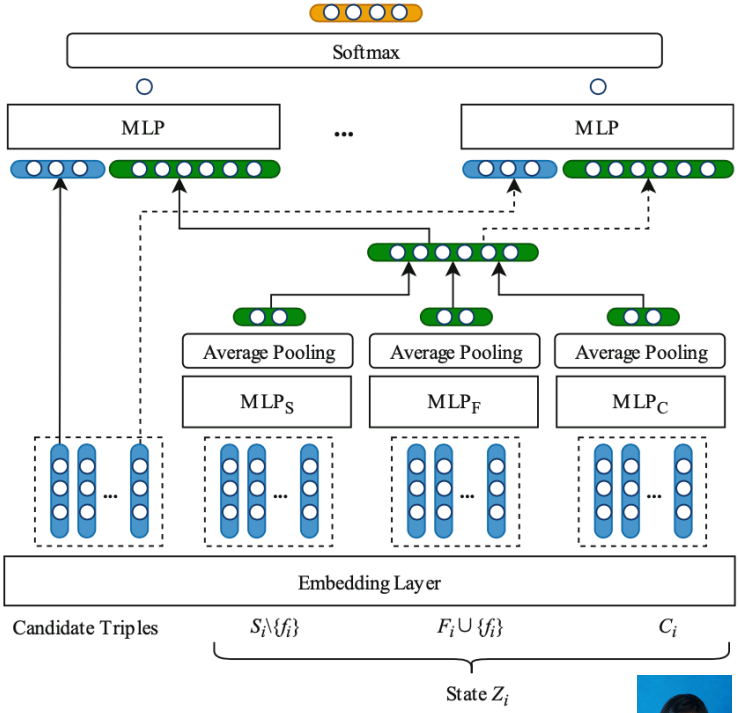

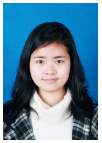

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Table 2. Overall results of offline evaluation (mean ± standard deviation). For each method, significant improvements and losses over other methods are indicated by ▲ ($p < 0.01$) or △ ($p < 0.05$), and by ▼ ($p < 0.01$) or ▽ ($p < 0.05$), respectively. Insignificant differences are indicated by ○.

	ESBM-D		ESBM-L		FED	
	NDCF@I	NDCG@I	NDCF@I	NDCG@I	NDCF@I	NDCG@I
FACES-E	$.435_{\pm.022}$ −▲▲▼▼▼	$.620_{\pm.017}$ −▲▲▼▼▼	$.373_{\pm.028}$ −▲▲▼▼▼	$.585_{\pm.027}$ −▲▲▼▼▼	$.263_{\pm.067}$ −▲▲▼▼▼	$.573_{\pm.063}$ −▲▲▼▼▼
IPS	$.405_{\pm.026}$ ▼−○▼▼▼	$.553_{\pm.023}$ ▼−○▼▼▼	$.278_{\pm.030}$ ▼−▼▼▼▼	$.410_{\pm.042}$ ▼−▼▼▼▼	$.212_{\pm.027}$ ▼−○▼▼▼	$.497_{\pm.009}$ ▼−▼▼▼▼
NRF	$.407_{\pm.021}$ ▼○−▼▼▼	$.554_{\pm.016}$ ▼○−▼▼▼	$.325_{\pm.029}$ ▼▲−▼▼▼	$.503_{\pm.034}$ ▼▲−▼▼▼	$.218_{\pm.033}$ ▼○−▼▼▼	$.510_{\pm.019}$ ▼▲−▼▼▼
PDGD-L	$.445_{\pm.037}$ ▲▲▲−○▽	$.632_{\pm.029}$ ▲▲▲−○▼	$.446_{\pm.027}$ ▲▲▲−○▼	$.699_{\pm.030}$ ▲▲▲−○▼	$.300_{\pm.031}$ ▲▲▲−○▼	$.628_{\pm.025}$ ▲▲▲−○▼
PDGD-N	$.447_{\pm.037}$ ▲▲▲○−○	$.636_{\pm.030}$ ▲▲▲○−▽	$.446_{\pm.025}$ ▲▲▲○−▼	$.698_{\pm.034}$ ▲▲▲○−▼	$.303_{\pm.033}$ ▲▲▲○−▼	$.630_{\pm.030}$ ▲▲▲○−▼
DRESSED	$.455_{\pm.032}$ ▲▲▲△○−	$.645_{\pm.028}$ ▲▲▲▲△−	$.481_{\pm.030}$ ▲▲▲▲▲−	$.760_{\pm.029}$ ▲▲▲▲▲−	$.316_{\pm.038}$ ▲▲▲▲▲−	$.644_{\pm.042}$ ▲▲▲▲▲−

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知识图谱中的实体摘要——未来探讨

- 知识图谱的语义
  - 文本语义、结构语义
  - 本体/逻辑语义
  - ……
- 非通用型实体摘要
  - 针对具体任务
  - 面向具体用户
  - 依赖具体上下文
  - ……
- 非抽取式实体摘要
  - 生成式
  - 聚合式
  - ……
- 从一到多
  - 多实体
  - 多图谱
  - ……

Nanchang (南昌市)

City in China

Nanchang is the capital and largest city of Jiangxi Province, People's Republic of China. As of November 2017, the total population in Nanchang City was 5,246,600, while the built-up area made of 6 urban districts plus Nanchang county is home to more than 4,300,000 inhabitants. Wikipedia

Area: 7,194 km²

Metropolitan area: 4,588 km²

Elevation: 37 m

Weather: 23°C, Wind N at 21 km/h, 30% Humidity

Province: Jiangxi

Local time: Sunday 1:42 pm


thankyou