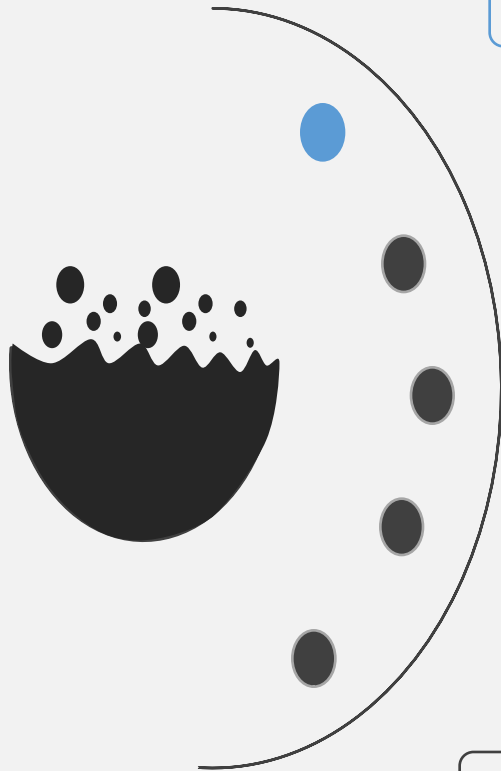


A Novel Rule Refinement Method for SMT through Simulated Post-Editing

Sitong Yang^{1,2}, Heng Yu^{?1}, and Qun Liu^{1,3}

1. Key Laboratory of Intelligent Information Processing. Institute of Computing Technology, Chinese Academy of Sciences
2. University of Chinese Academy of Sciences
3. CNGL, School of Computing, Dublin City University





Post-Editing

Pros & Cons

Our method

Data set & Experiment

Conclusion & Future Work

Post Editing(PE)



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Post Editing(PE)

Automatic post editing



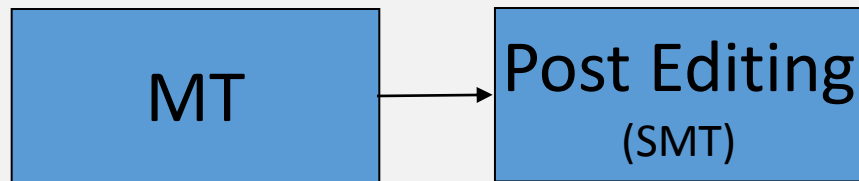
Post Editing(PE)



MT



Post Editing(PE)



Post Editing(PE)



Post Editing(PE)



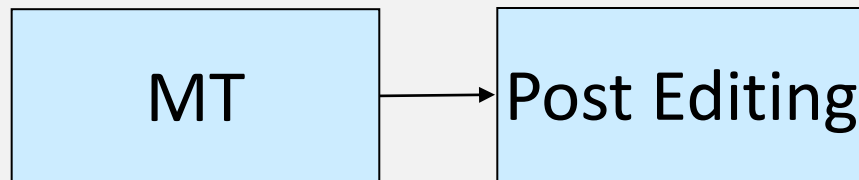
Multiple stream

Post Editing(PE)

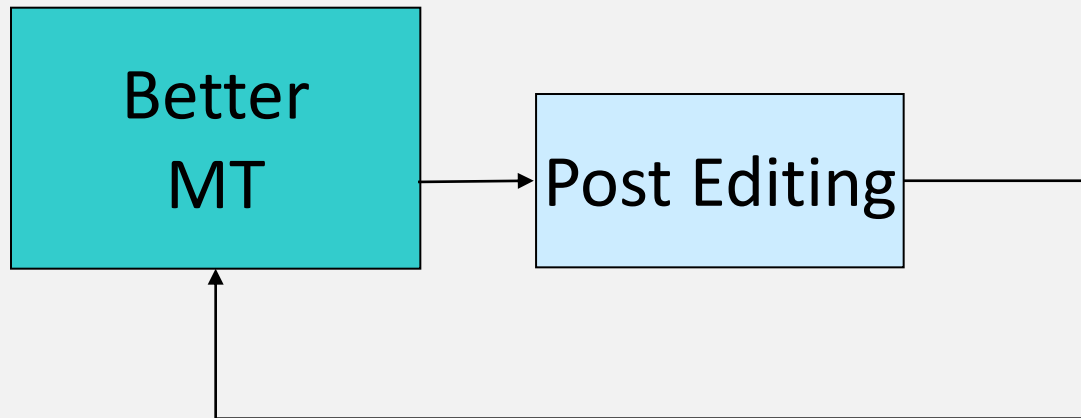
MT



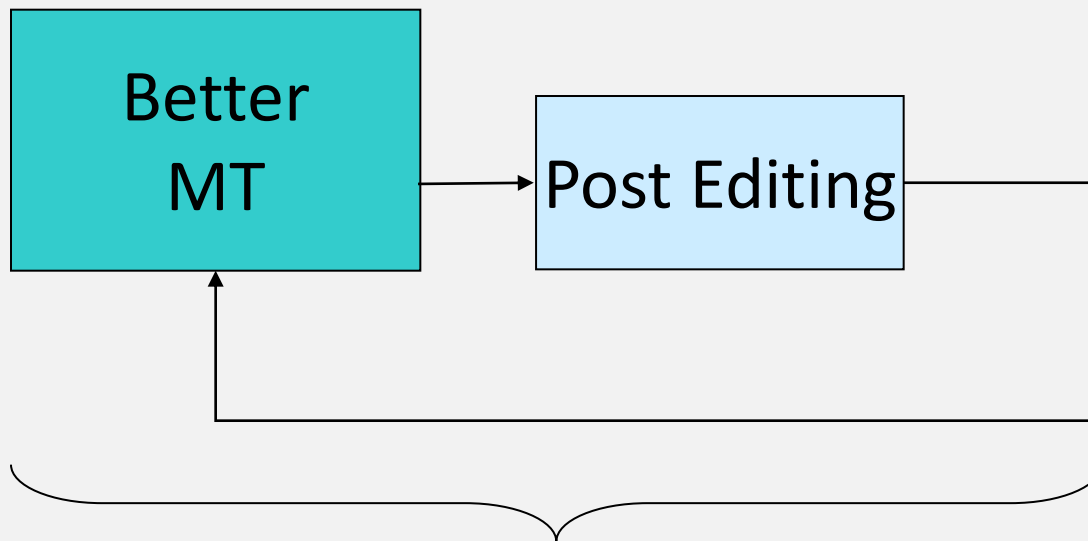
Post Editing(PE)



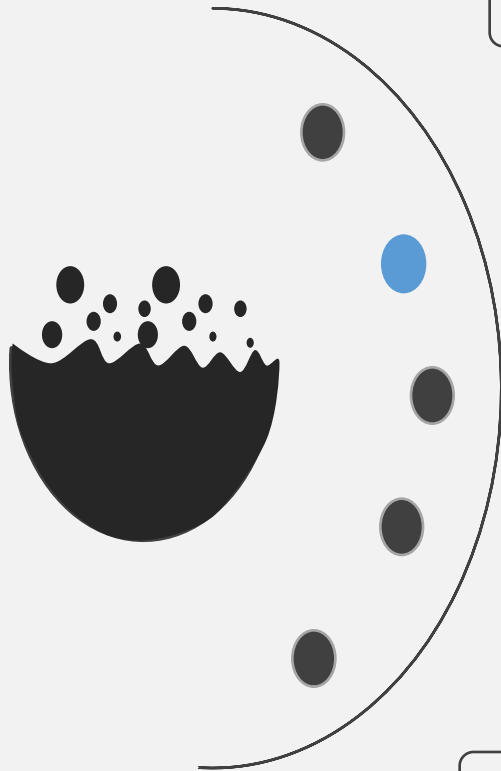
Post Editing(PE)



Post Editing(PE)



Single stream



Post-Editing

Pros & Cons

Our method

Data set & Experiment

Conclusion & Furture Work

Pros & Cons

Pros:



Pros & Cons

Pros:

- Better adaptation



Pros & Cons

Pros:

- Better adaptation
- No additional burden for SMT



Pros & Cons

Pros:

- Better adaptation
- No additional burden for SMT

Cons:



Pros & Cons

Pros:

- Better adaptation
- No additional burden for SMT

Cons:

- Expensive



Pros & Cons

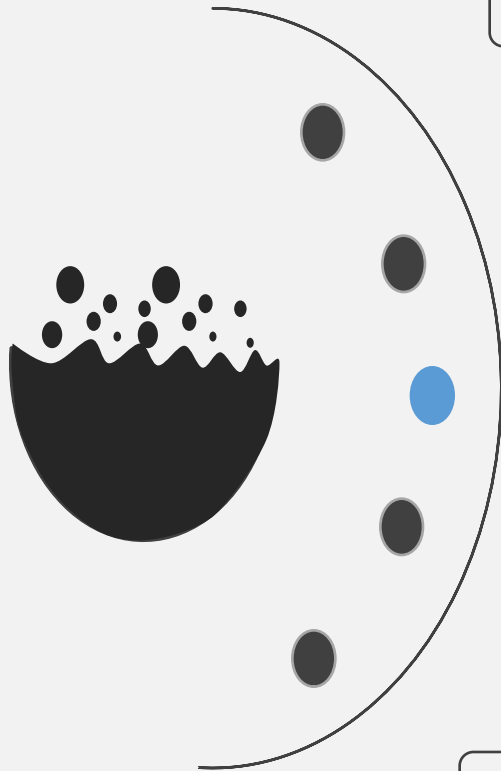
Pros:

- Better adaptation
- No additional burden for SMT

Cons:

- Expensive
- Hard to learn





Post-Editing

Pros & Cons

Our method

Data set & Experiment

Conclusion & Furture Work

Our method

We Learn from PE results to enhance the original SMT Model.



Our method

We Learn from PE results to enhance the original SMT Model.

- Simulated Post Editing



Our method

We Learn from PE results to enhance the original SMT Model.

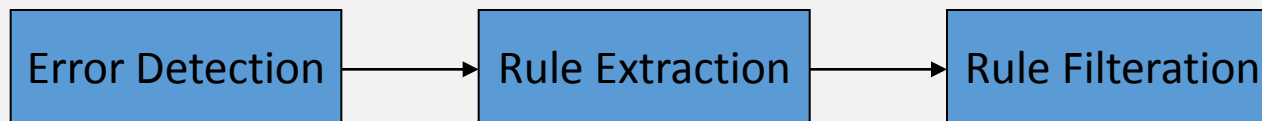
- Simulated Post Editing
- Error-Driven Frame work



Our method

We Learn from PE results to enhance the original SMT Model.

- Simulated Post Editing
- Error-Driven Frame work



Simulated PE

[Daniel \[2010\]](#) formulated the task of simulated post-editing, wherein **pregenerated reference translations** are used as a stand-in for actual post-editing.

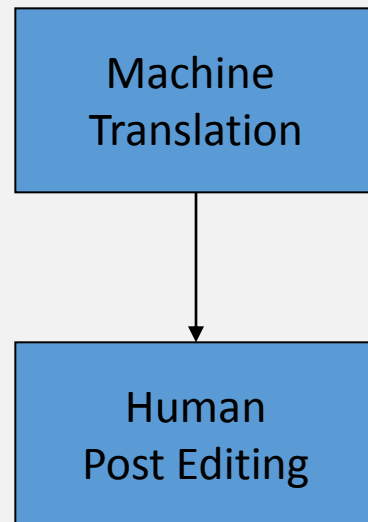


Simulated PE

Machine
Translation

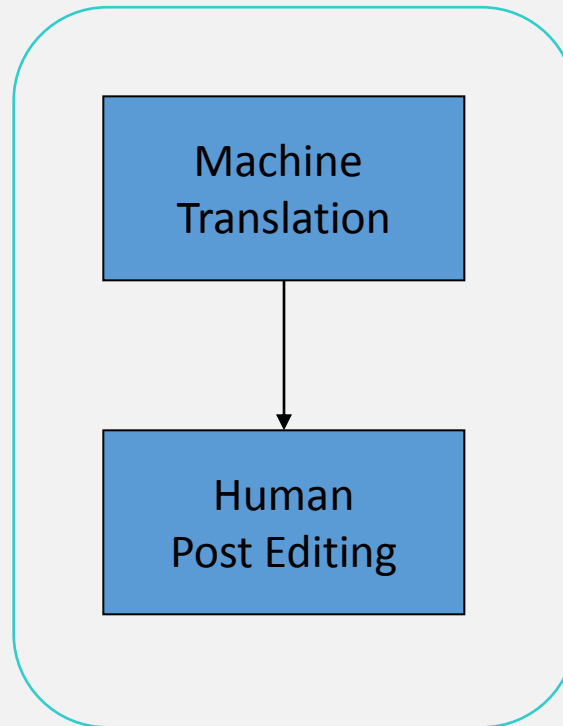


Simulated PE



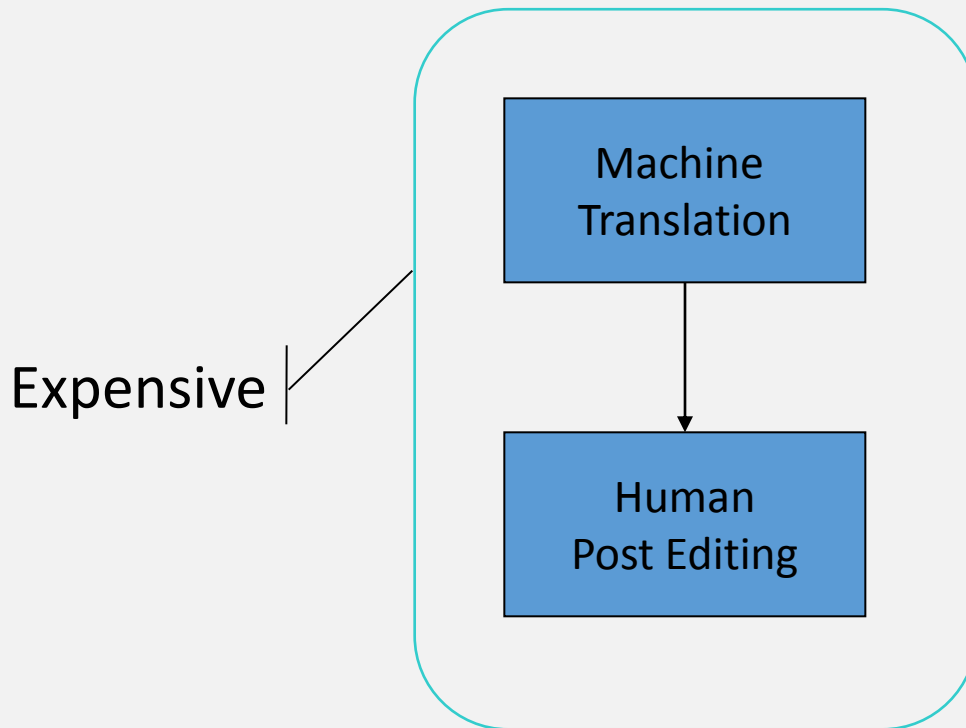
Simulated PE

PE



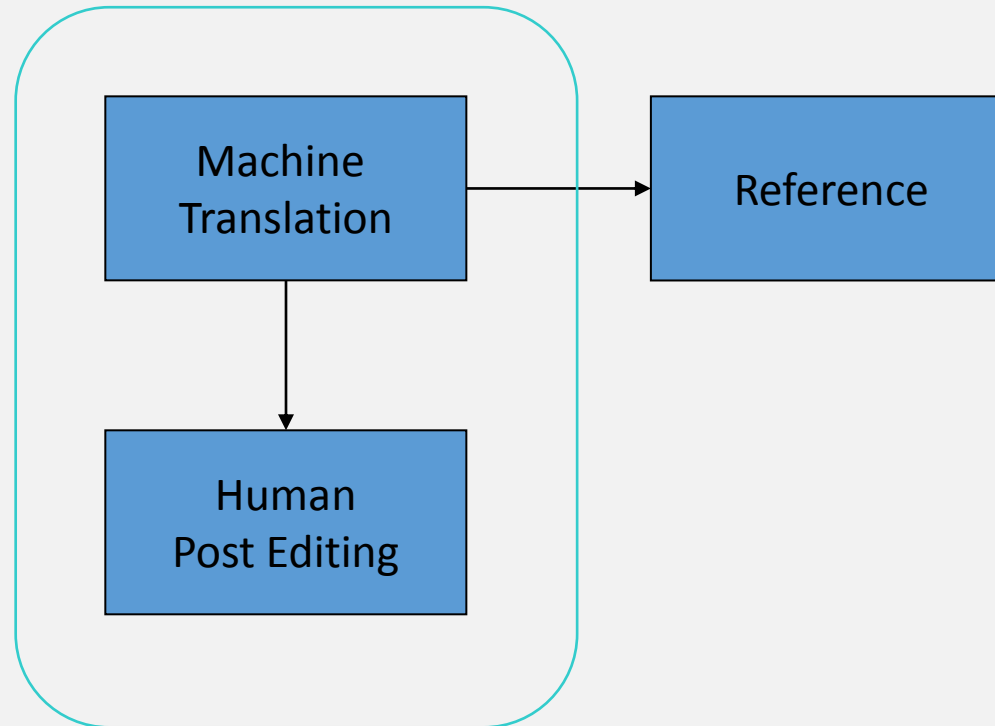
Simulated PE

PE



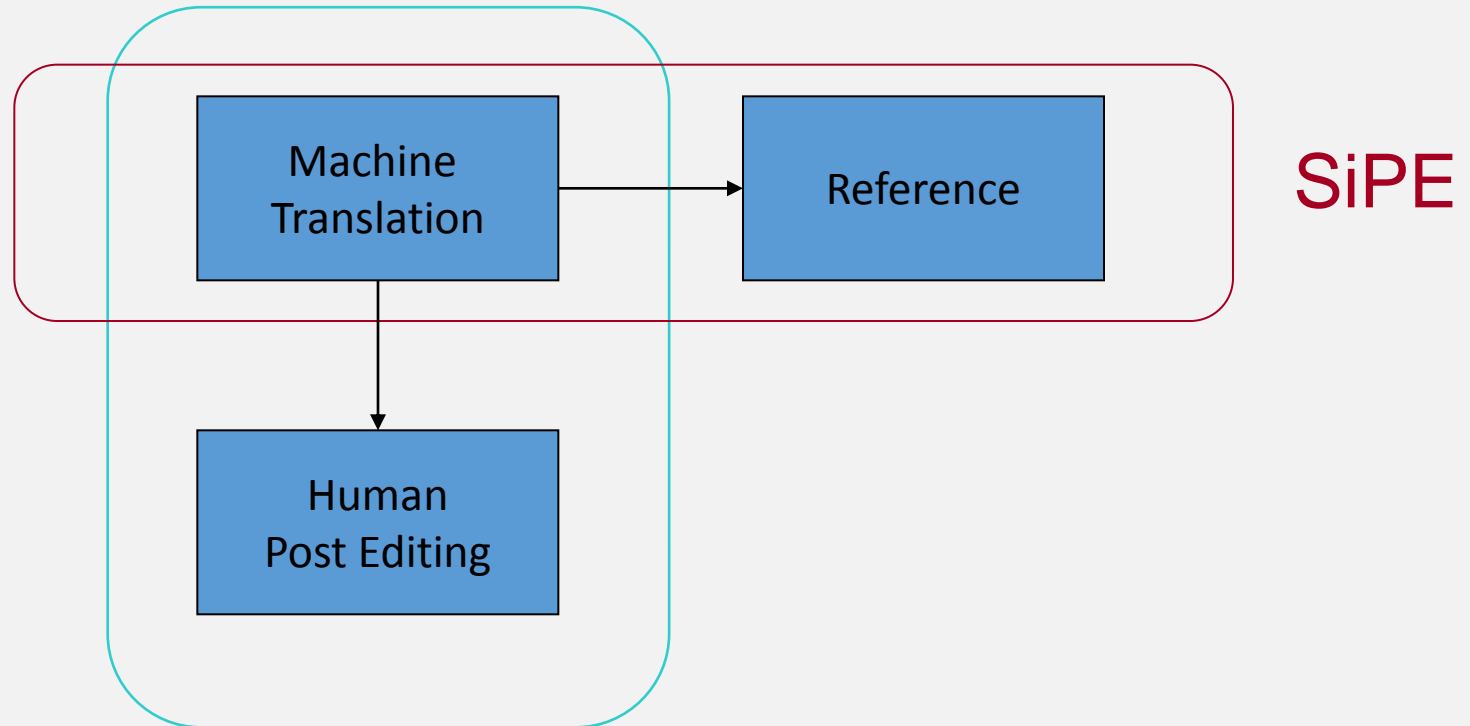
Simulated PE

PE

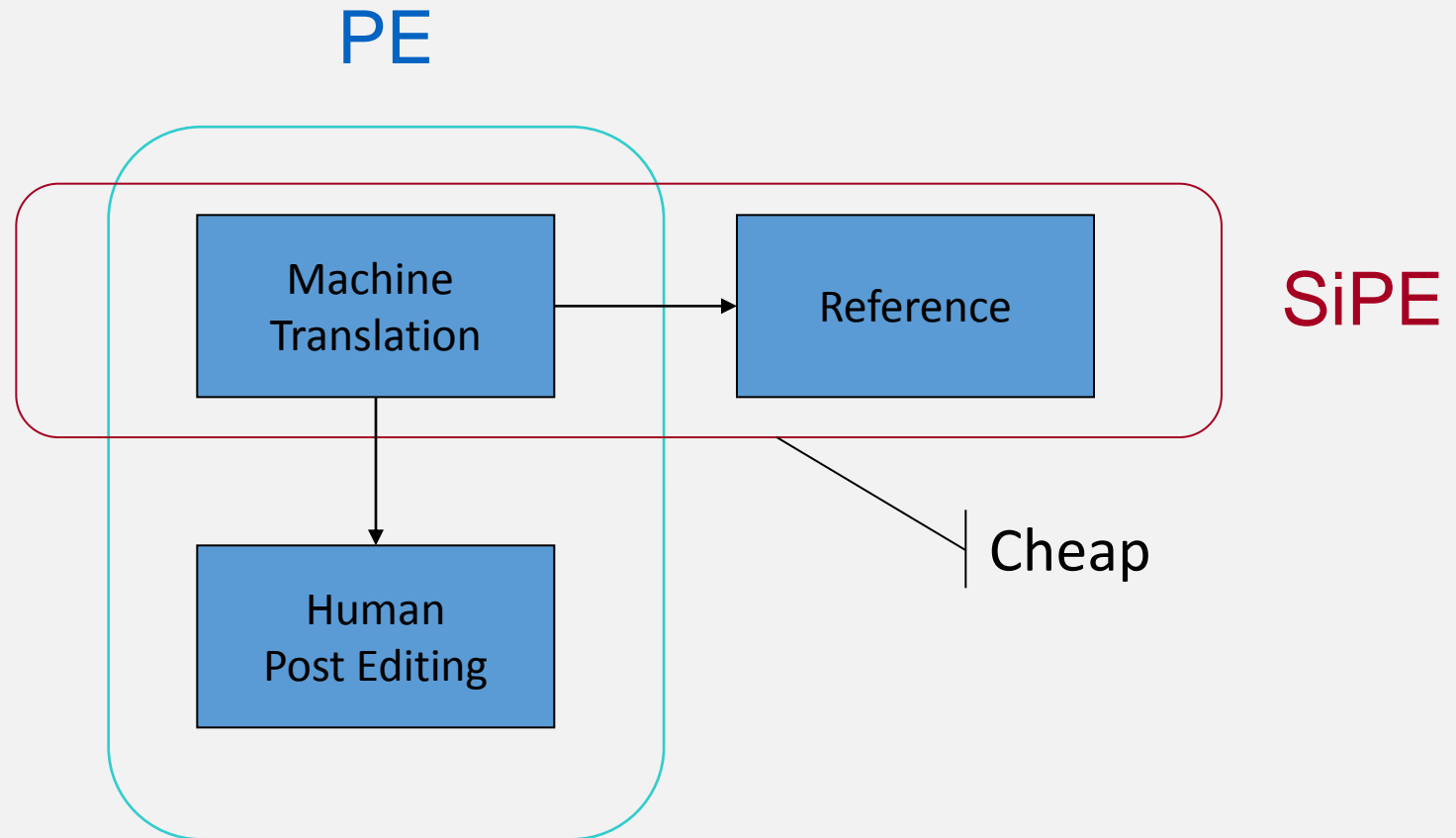


Simulated PE

PE



Simulated PE



Error-Driven Rule Refinement



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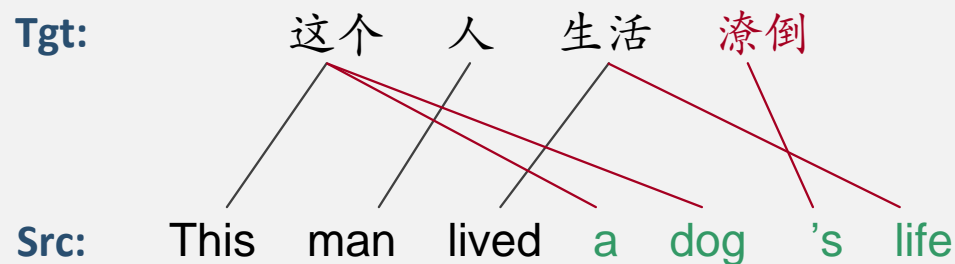
Error-Driven Rule Refinement

Tgt: 这 个 人 生 活 潦 倒

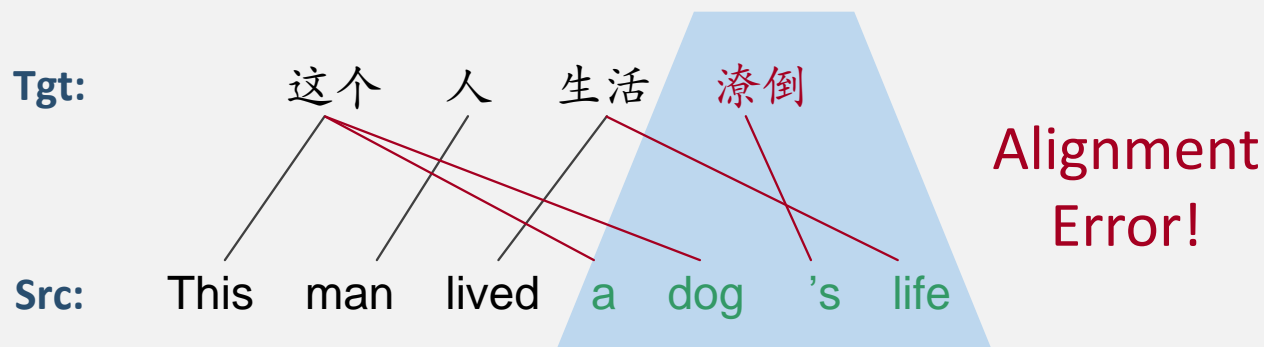
Src: This man lived a dog 's life



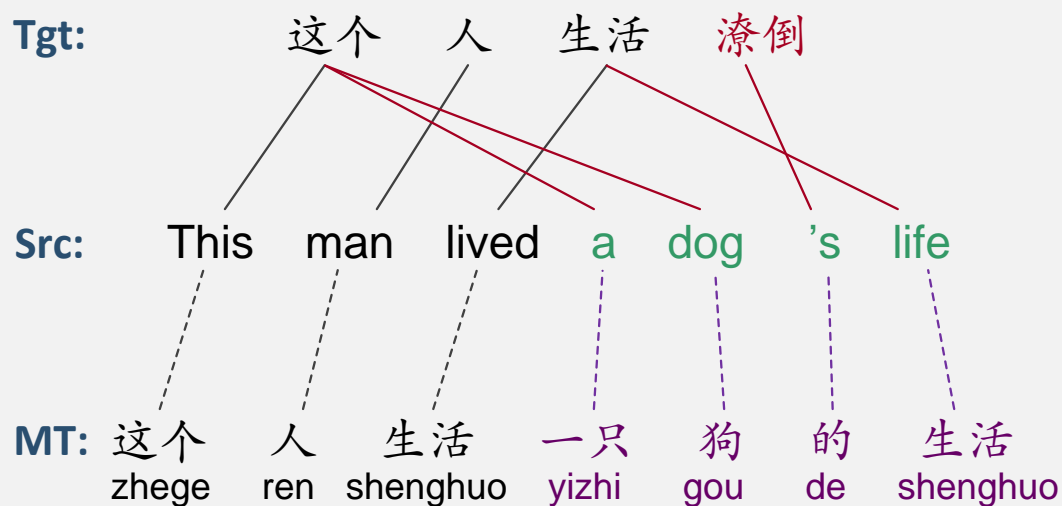
Error-Driven Rule Refinement



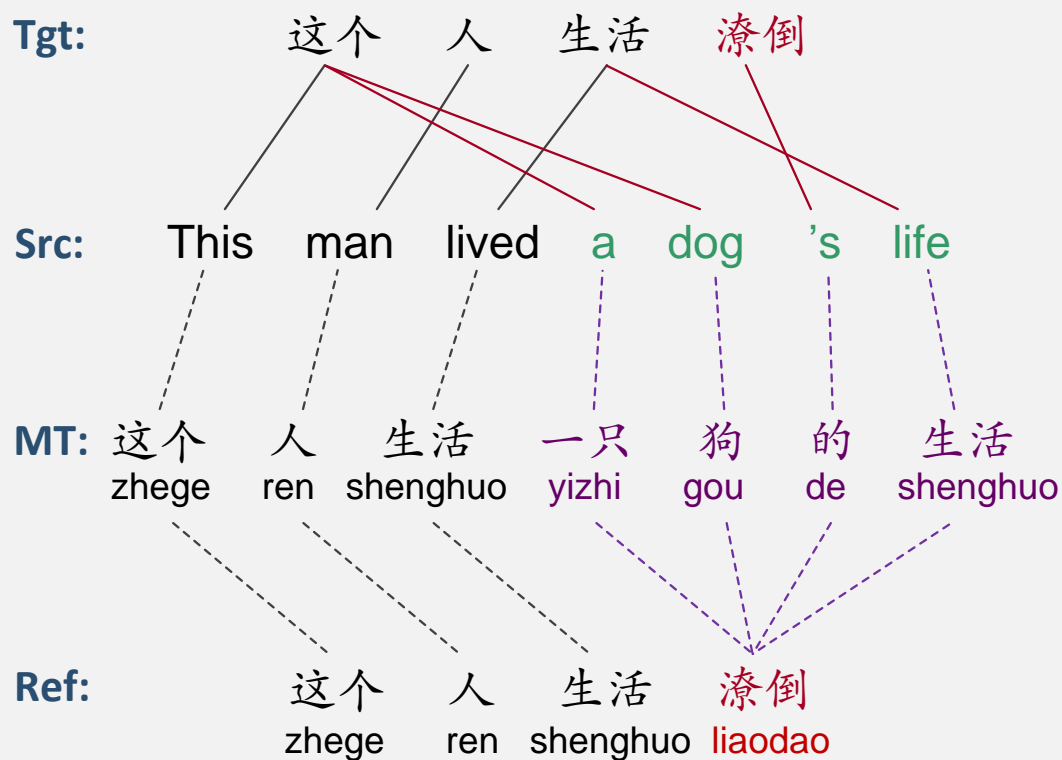
Error-Driven Rule Refinement



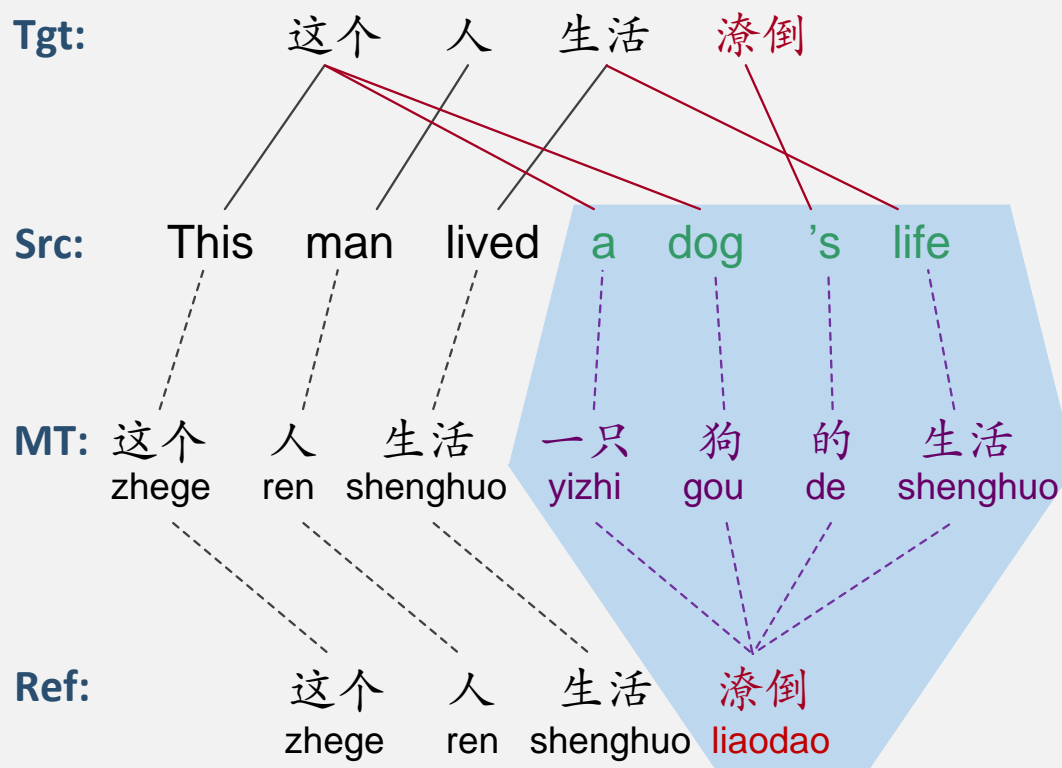
Error-Driven Rule Refinement



Error-Driven Rule Refinement



Error-Driven Rule Refinement



Error Detection



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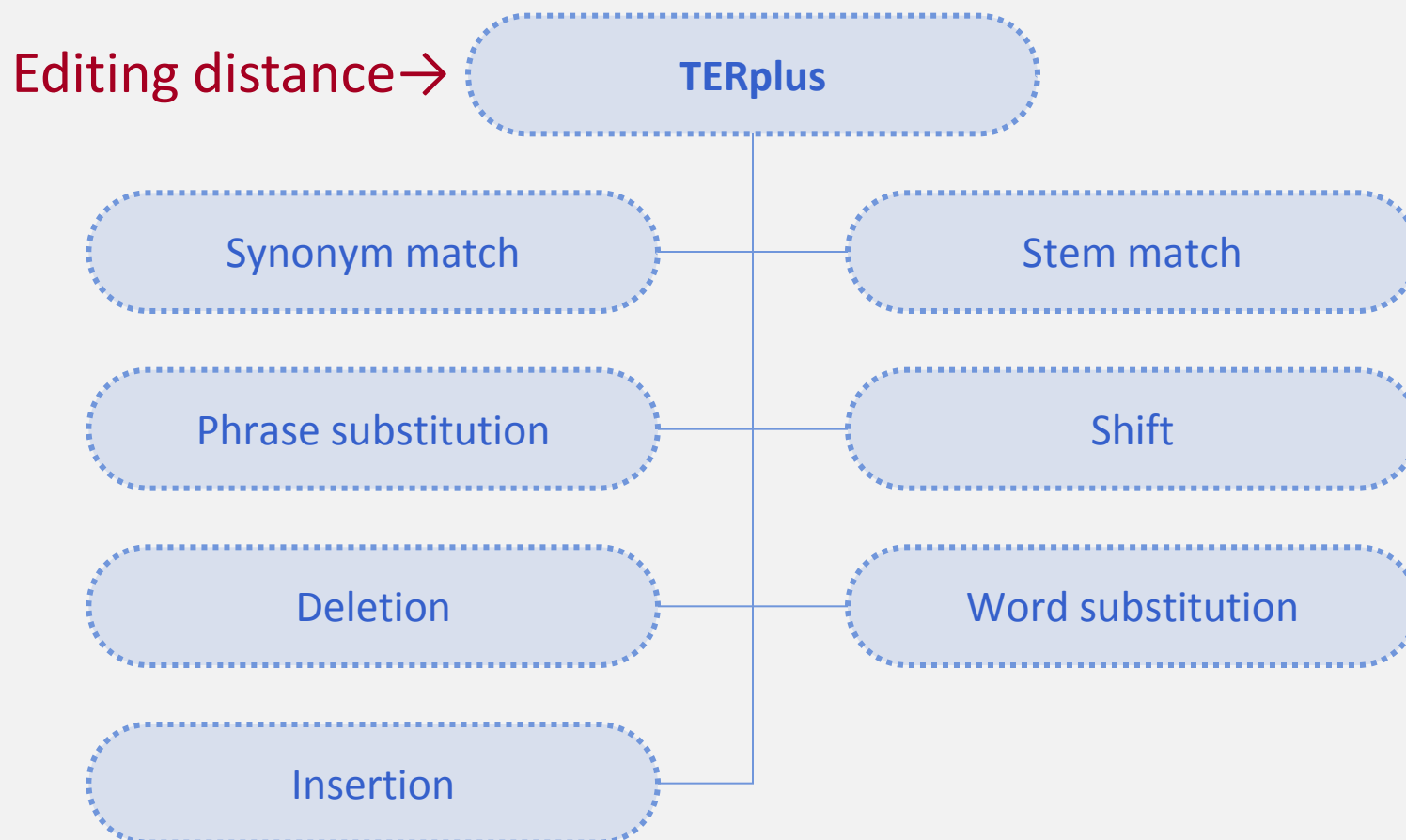
2014/12/23

Error Detection

Editing distance



Error Detection



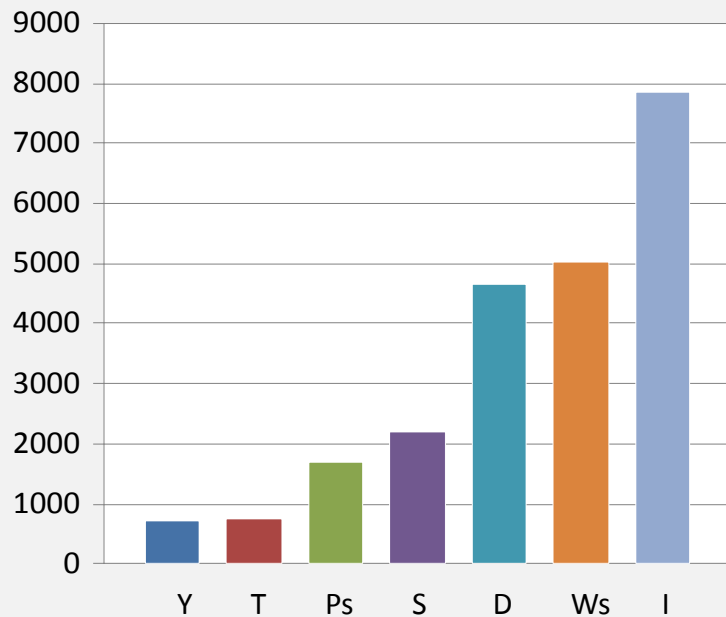
Error Detection

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	SentenceID:st[doc][1]													
2	[REF-NEW]	however	,	on	today	's	college	campuses	,	the	computer	network	,	academic
4	[HYP-SHI]	but	in	the	campus	of	the	university	,	the	internet	and	academic	
5	[ALIGNME]	D	S	S	S	S	S	P			D	P	S	
6	[HYP-MAP]	0	1	2	3	4	5	6	7	8	9	10	11	12
7														
8	SentenceID:st[doc][2]													
9	[REF-NEW]	wang	ongguang	,	secretary	of	the	party	ommittee	in	the	shanghai	jiaotong	university
11	[HYP-SHI]	as	,	secretary	of	the	party				shanghai	jiaotong	university	
12	[ALIGNME]	D	S						D	D	D			
13	[HYP-MAP]	0	18	3	4	1	2	5	6	7	26	8	9	10
14														
15	SentenceID:st[doc][3]													
16	[REF-NEW]	right	now	,	student	anizations	and	various	academic	partments	of	many	colleges	have
18	[HYP-SHI]	at	present	,	many	and			college	anizations	,	all	schools	have
19	[ALIGNME]	S	S		D	S		D	S	P	S	S	P	
20	[HYP-MAP]	0	1	2	3	8	4	6	7	9	10	11	12	13
21														
22	SentenceID:st[doc][4]													
23	[REF-NEW]	in	face	of	the	situation	in	which	societies	and	anizations	pay	excessive	attention
25	[HYP-SHI]	in	view	of	the			weight	technical	and	anizations			
26	[ALIGNME]		S			D	D	S	S			D	D	D
27	[HYP-MAP]	0	1	2	3	4	6	7	9	42	8	10	11	17

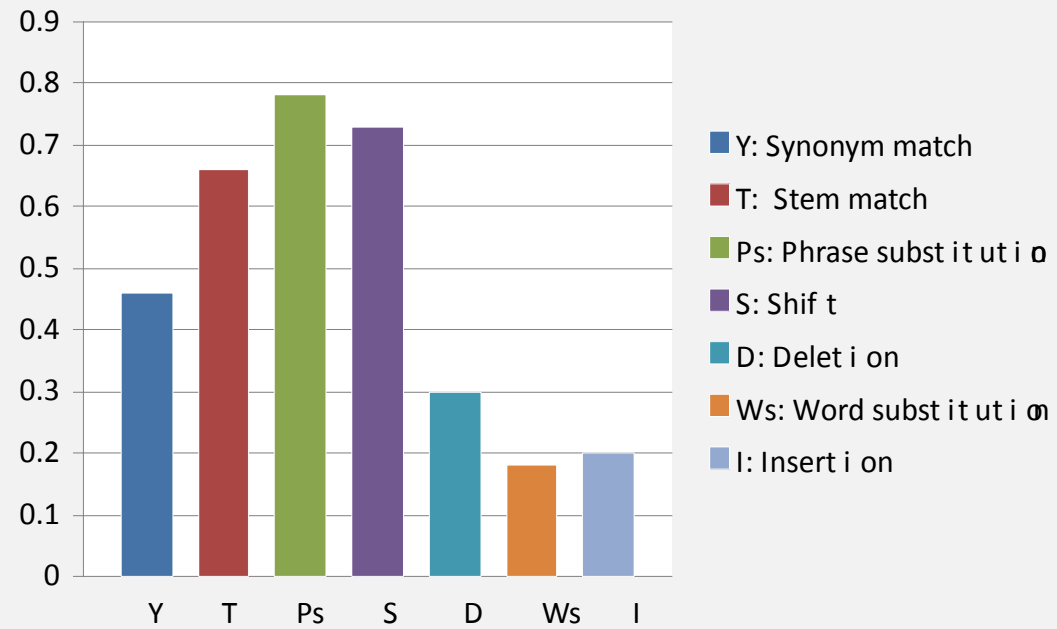


Error Detection

SiPE Distribution



SiPE Precision

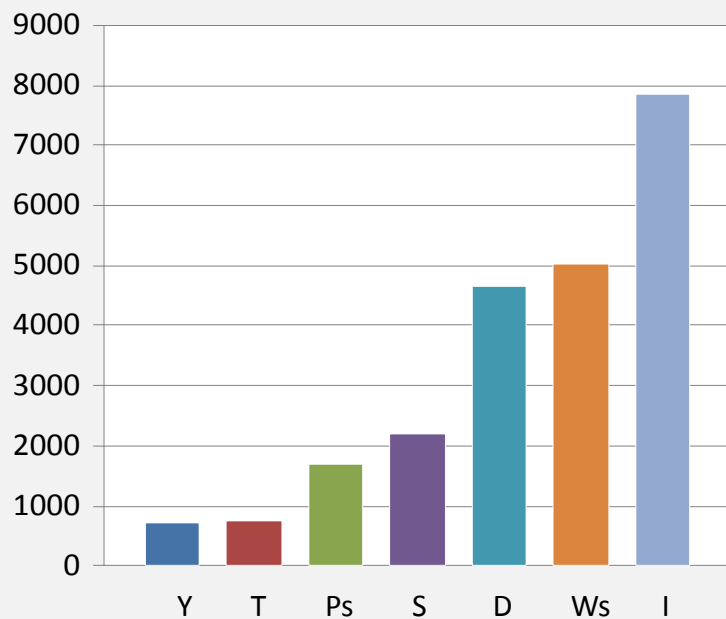


- Y: Synonym match
- T: Stem match
- Ps: Phrase substitution
- S: Shift
- D: Deletion
- Ws: Word substitution
- I: Insertion



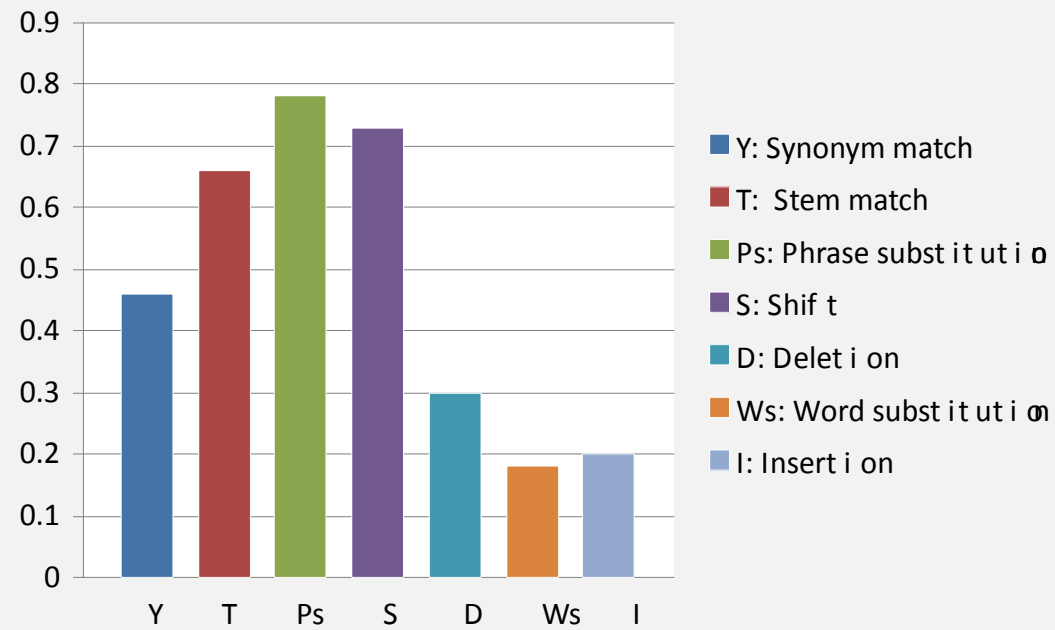
Error Detection

SiPE Distribution



small sample

SiPE Precision

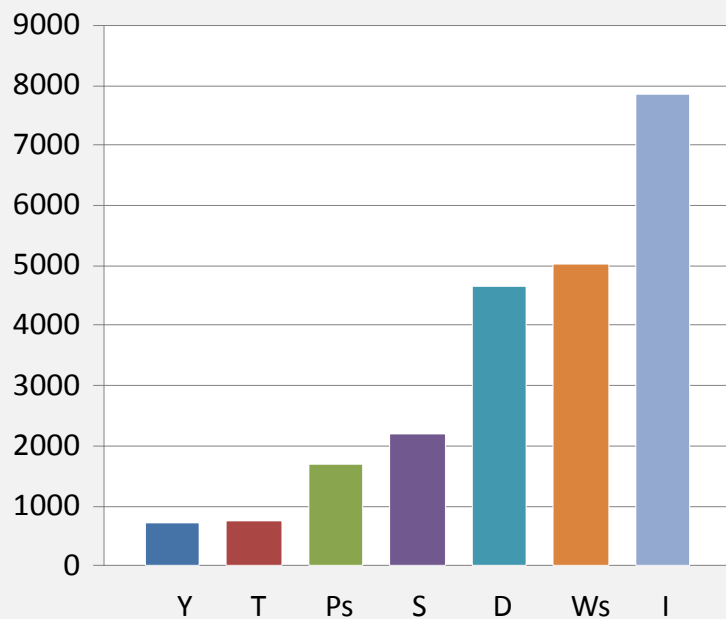


hard to learn

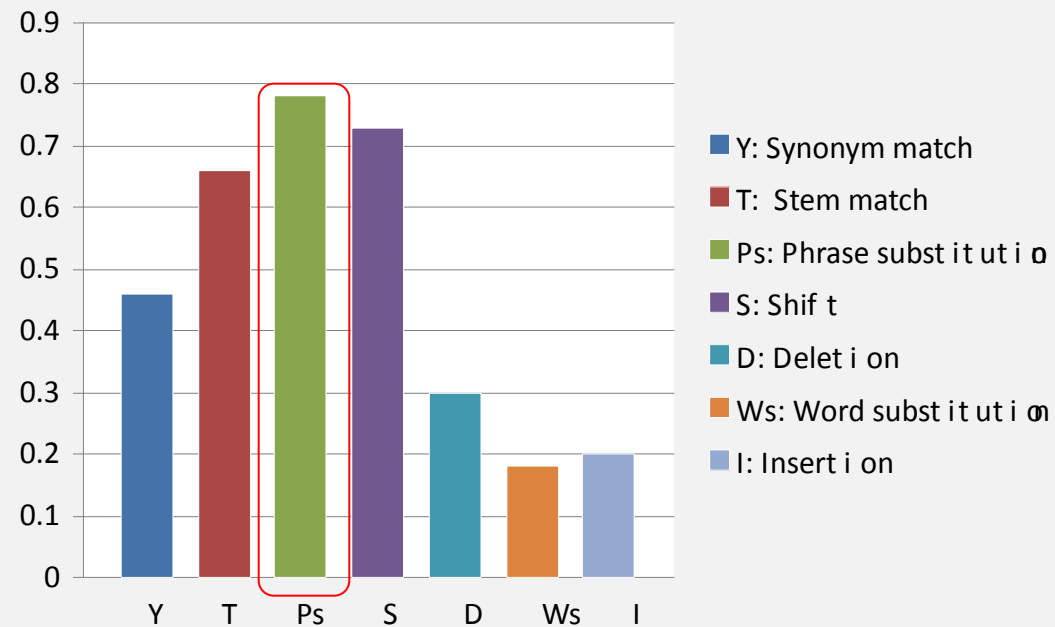


Error Detection

SiPE Distribution



SiPE Precision



- Y: Synonym match
- T: Stem match
- Ps: Phrase substitution
- S: Shift
- D: Deletion
- Ws: Word substitution
- I: Insertion



Rule extration and Filtration

Filtration



Rule extration and Filtration

Filtration

- C (words of Context)
- P (words of Source side Substitution part)

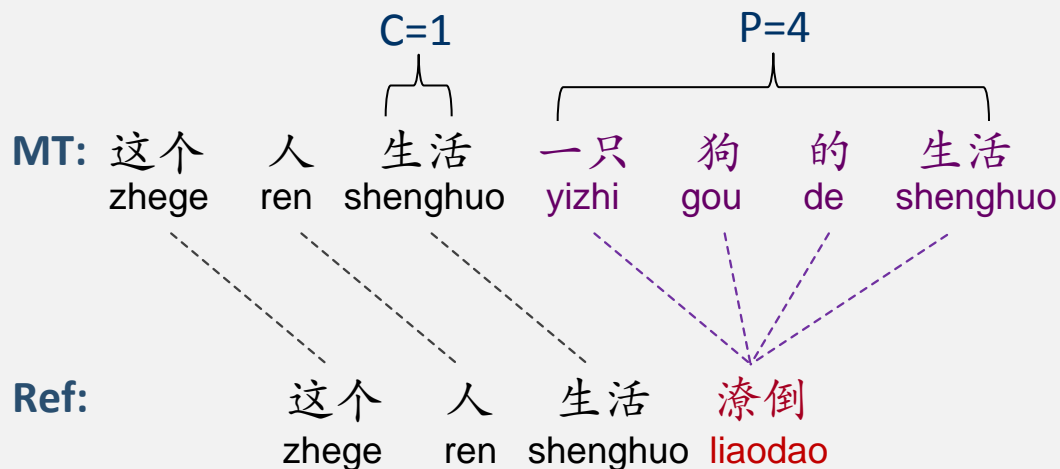


Rule extration and Filtration

Extration

Monolingual rule:

生活 一只狗的生活 ||| 生活 潦倒



Rule extration and Filtration

Extration

Monolingual rule:

生活 一只狗的生活 ||| 生活 潦倒

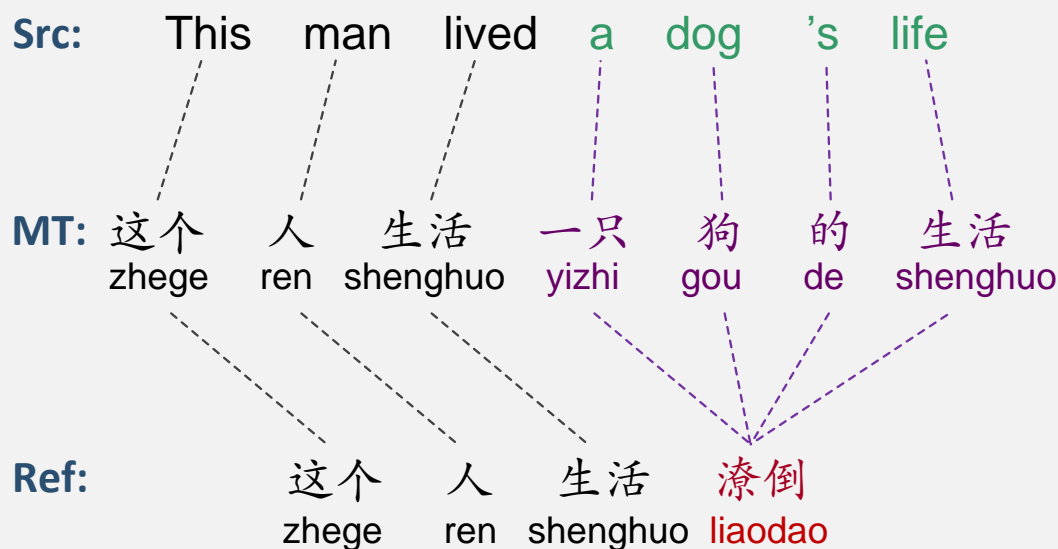


Rule extration and Filtration

Extration

Monolingual rule:

生活 一只狗的生活 ||| 生活 潦倒



Rule extration and Filtration

Extration

Monolingual rule:

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Rule extration and Filtration

Extration

Monolingual rule:

生活 一只狗的生活 ||| 生活 潦倒

Original Bilingual rule :

lived a dog 's life ||| 生活 一只 狗 的 生活 ||| 0.5 0.0149508 0.4 7.97148e-06 2.718



Rule extration and Filtration

Extration

Monolingual rule:

生活 一只狗的生活 ||| 生活 潦倒

Original Bilingual rule :

lived a dog 's life ||| 生活 一只 狗 的 生活 ||| 0.5 0.0149508 0.4 7.97148e-06 2.718

New rule:

lived a dog 's life |||生活 潦倒 ||| 0.5 0.0149508 0.4 7.97148e-06 2.718



Filtering Criterion



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Filtering Criterion

the	beginning	of	the	new
the	opening			

C=1 P=3

calming	the	emotions	of
calming	the	feelings	of

C=2 P=2

to	open	up	and
	opening	up	and

C=2 P=1

between	the	faculty	members	and
between		teachers		and

C=2 P=3

Filtering Criterion

the	beginning	of	the	new
the	opening			

C=1 P=3

calming	the	emotions	of
calming	the	feelings	of

C=2 P=2

to	open	up	and
	opening	up	and

C=2 P=1

between	the	faculty	members	and
between		teachers		and

C=2 P=3

Filtering Criterion

the	beginning	of	the	new
the	opening			

C=1 P=3



to	open	up	and
	opening	up	and

C=2 P=1



calming	the	emotions	of
calming	the	feelings	of

C=2 P=2



between	the	faculty	members	and
between		teachers		and

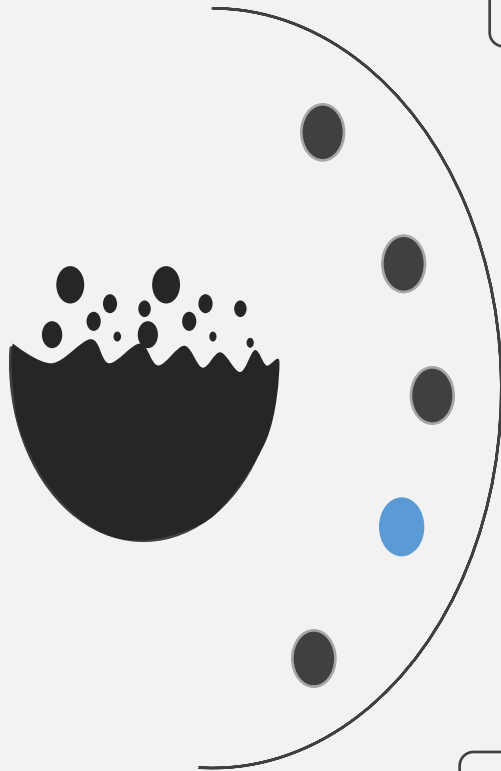
C=2 P=3



Filtering Criterion

- Should Contain More Context ($c \geq 2$)
- More Accurated Substitution ($2 \leq p \leq 5$)





Post-Editing

Pros & Cons

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Experiments-Setup

- Baseline system:

Moses: a state-of-art phrase-based SMT system

Hiero: Hierarchical phrase-based system

- Word-alignment tool: [GIZA++](#)
- Language model: [SRILM toolkit](#)
- MT evaluation metric: [Case-insensitive Bleu-4](#), [Ter-plus](#)



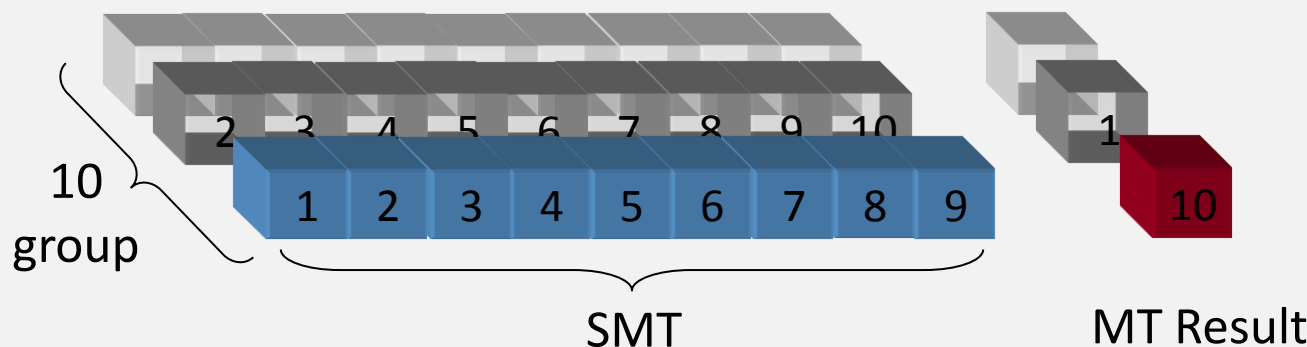
Experiments-Setup

- Data Set:

Domain	Language	Training-set	Dev-set	Test-set		
News	C2E	240k	Nist02	Nist04	Nist05	Nist06
Medical	C2E	560K	1000	1000		

- SiPE dataset:

Training-set: 10-fold cross validation



Main Results: Rule Refinement Method

- new

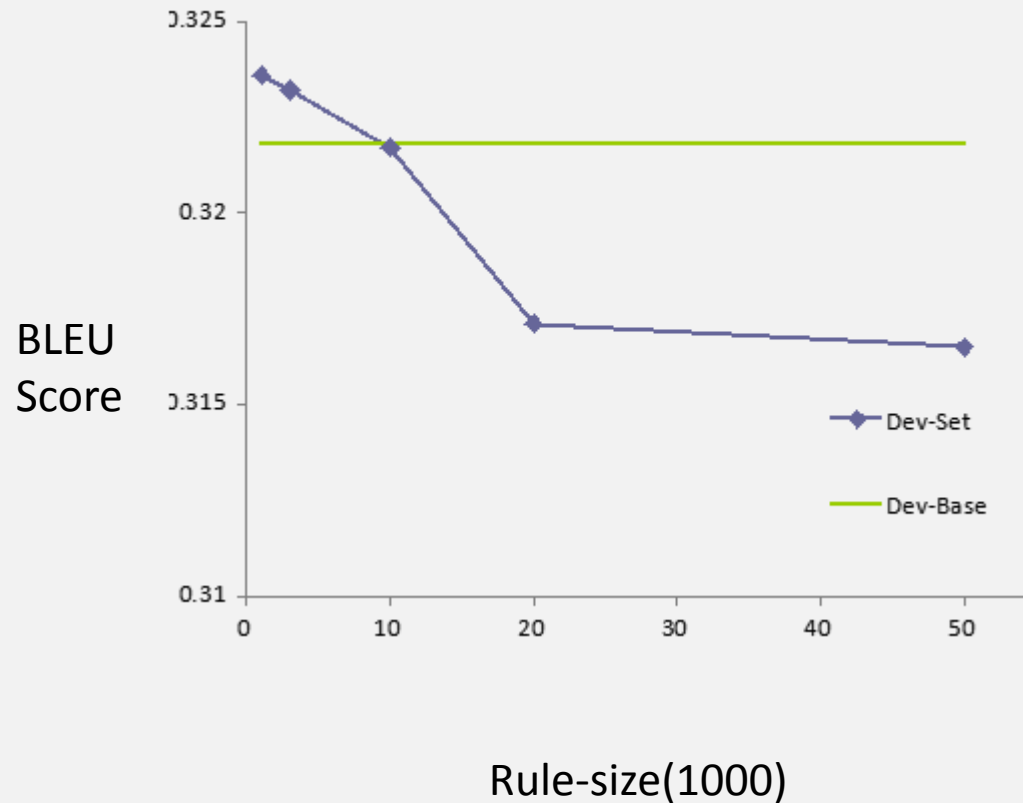
System	Bleu				TERp			
	04	05	06	avg	04	05	06	avg
moses	32.02	29.00	27.18	29.34	61.47	64.04	66.45	64.47
balanced	33.47	30.02	28.80	30.76	60.24	59.37	63.89	61.77
hiero	34.10	29.89	28.78	30.92	59.55	62.73	64.84	62.37
balanced	34.09	29.87	28.81	30.92	59.56	62.75	64.85	62.38

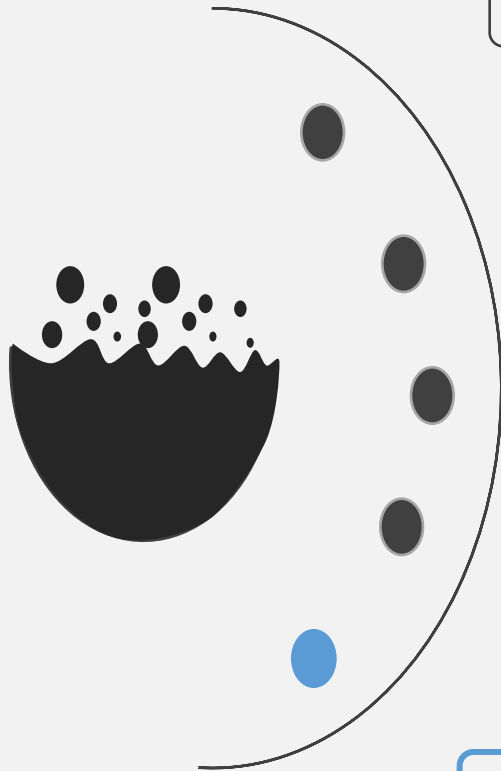
- medical

System	Bleu	TERp
moses	29.64	66.06
ours	30.15	63.80
hiero	29.48	63.53
ours	30.26	62.57



Main Results: Rule Filtration





Post-Editing

Pros & Cons

Our method

Data set & Experiment

Conclusion & Furture Work

Conclusion & Future work

Conclusion:

- a novel rule refinement method for SMT.
- a **simulated post-editing** paradigm to efficiently collect the training data.
- **TER-Plus** for translation error detection.
- a simple and effectively heuristic algorithm for **rule-filtration**.
- both phrase-based and syntax-based SMT systems.
- gains an overall improvement of **1.4 BLEU** point without using any additional resources.

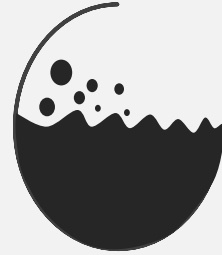


Conclusion & Future work

Future work:

- test our method on more complex translation models.
- produce more powerful feedbacks to improve SMT systems.





Thanks for your attention!