The SLE Example-Based Translation System

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SHARP

Background

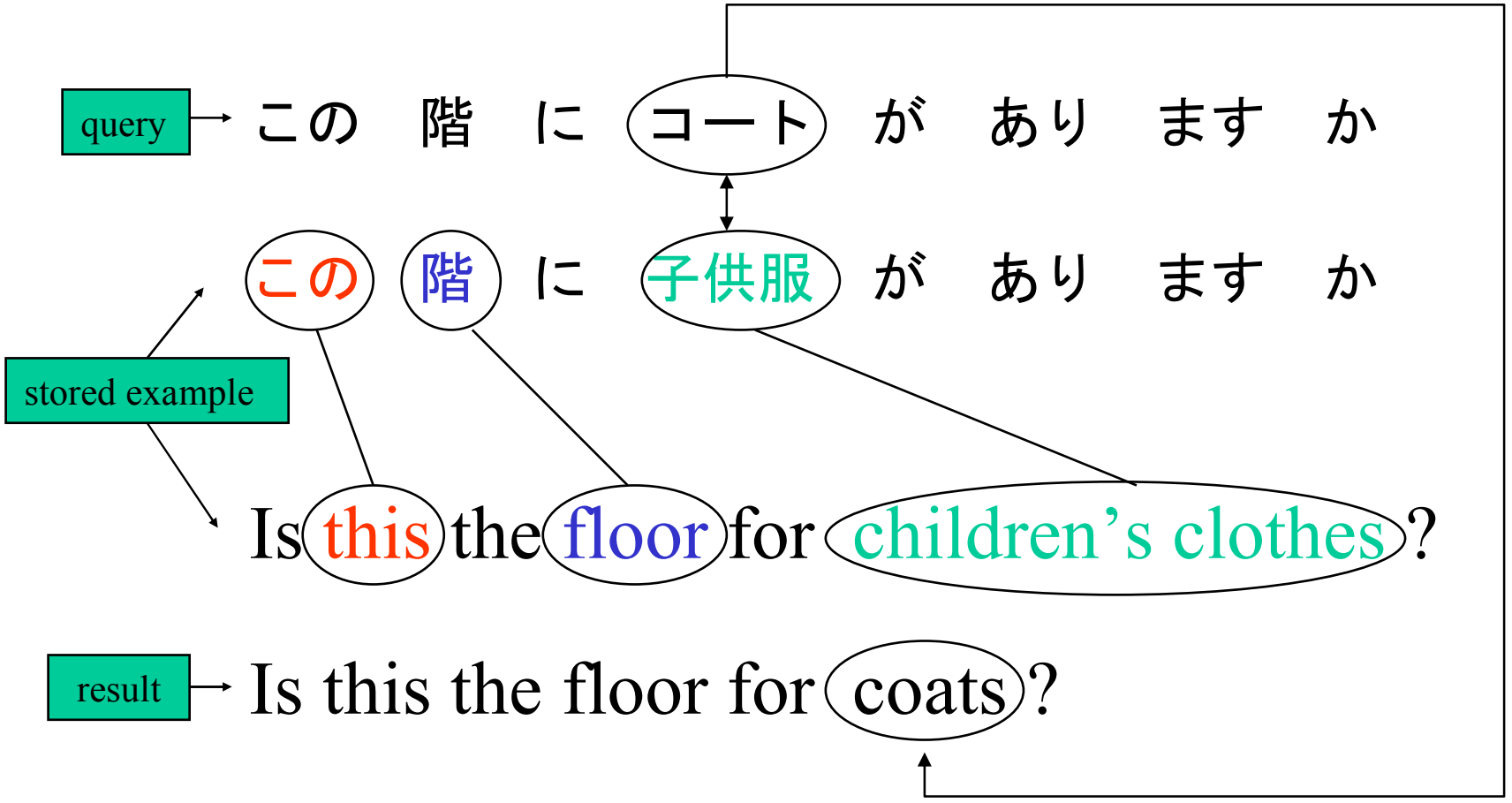
- 1970s – work by Sharp Corp. on E→J MT
  Duet, Power E/J, これ一本 (PC package)

- 1997-2003 – SLE's Intelligent Dictionary
  おまかせ　訳振り (lightweight English analysis)

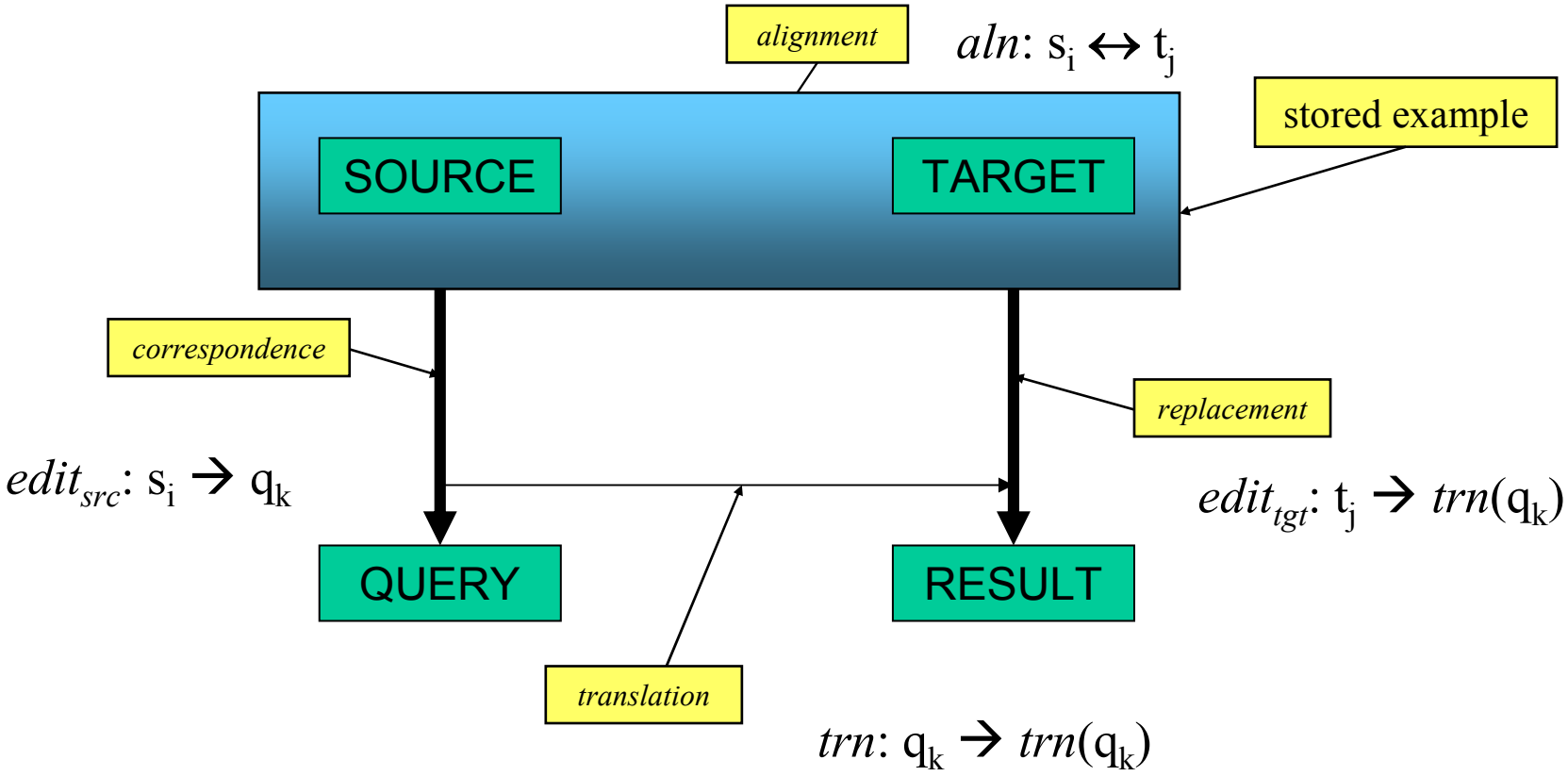
- 2003-2005 – SLE work on bilingual example retrieval and TM (~EBMT) functions for package

- 2005-2006 – SLE extend EBMT
  - Improve accuracy
    - include lightweight dependency analysis
  - Reduce resource utilisation for low power device
    - no language model
    - replace recursive use of TM with dictionary

Example


query
この 階 に コート が あり ます か
この 階 に 子供服 が あり ます か
stored example
Is this the floor for children's clothes?
result
Is this the floor for coats?

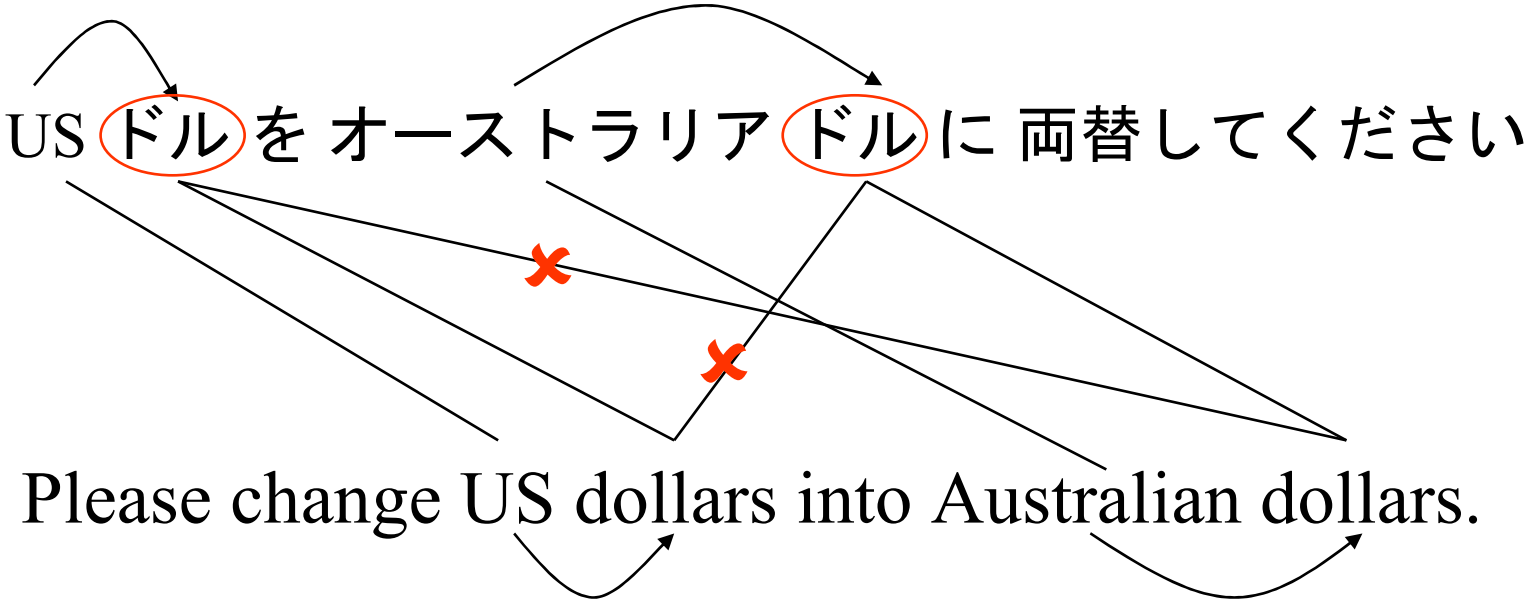
Edit Model


alignment
aln: $s_i \leftrightarrow t_j$
stored example
SOURCE
TARGET
correspondence
replacement
$edit_{src}$: $s_i \rightarrow q_k$
$edit_{tgt}$: $t_j \rightarrow trn(q_k)$
QUERY
RESULT
translation
trn: $q_k \rightarrow trn(q_k)$

Alignment

- Sentence aligned bitext =>

  (partial) alignment of (sets of) words
- Bilingual dictionary/thesaurus + dependency analysis
  - Constraint propagation
  - Use dependency proximity to resolve ambiguity
  - Annotate examples with semantic (thesaurus) codes of bilingual entries used
- Special routines
  - Number parser for English and Japanese
  - Readings of kanji proper names as found by Japanese morphological analyser
  - Katakana to English edit rules +dp spell check


US ドル を オーストラリア ドル に 両替してください
Please change US dollars into Australian dollars.

Correspondence

- Example base is indexed by words, lemmas, semantic codes
- Retrieve candidate examples which share index terms with query
  - don't prefer rare terms, so obtain templatic effect.
- Compute sequence of matched and unmatched stretches
  - determine score based on these
  - adjust score by semantic overlap in unmatched stretches
- Use example with best score as basis for translation


14206 CLOTHES
16224 SPORTS PLACE
この 階 に コート が あり ます か
query
14206 CLOTHES
overlap = 5
この 階 に 子供服 が あり ます か
Is this the floor for children's clothes?
examples
16232 STORE
overlap = 3
この 階 に レストラン が あり ます か
Is there a restaurant on this floor?

Translation

- Dependency-analyse query
- Find set of bilingual entries matching query
- Find maximum consistent (tiling) set
  - prefer entries covering more items
  - prefer entries with semantic codes consistent with those determined in correspondance
  - prefer entry used most frequently in corpus
- Pass the set to replacement phase

Translation

PRIO 3.15	at_PREP ← +clocktime ⇔ NUM 時 に
PRIO 2.05	he_PRON ⇔ 彼 → は
PRIO 1.1	get_V ← back_ADV ⇔ 戻る_VERB

彼 は	５ 時	に	戻り ます 。
彼 は	月曜日	に	戻り ます 。

He'll be back on Monday.

*He'll be back at 5 o'clock

Replacement

- Determine positions in basis to be substituted
  - by examination of alignment relation
- Apply TL edit
  - deletion
    - delete words at positions in basis
    - delete determiners and prepositions when their head is deleted
  - substitution
    - substitute head position in basis by translations of words in query
    - delete words at all other substitution positions in basis
  - insert
    - insertion is adnominal – add head noun to both sides of source edit
      - assimilate insertion to substitution
    - insertion is adverbial – add translation to start or end of sentence
  - handle cases of boundary friction
    - *a/an* alternation, removal of multiple prepositions
    - apply number agreement
    - generate inflected comparatives and superlatives
    - copy features from basis to output

Feature Copy

この	電車	は	定刻に	出発	の	予定	です か。
この	便	は	定刻に	到着	の	予定	です か。

Will this flight arrive on time?
Will this *t*(電車) *t*(出発) on time?
Will this train departure on time?

N→V

Will this train depart on time?

Results

	BBS	SLE Example Base (~13,000)			SLE+IWSLT Example Base (~53,000)		
		EBMT Only	%age	+BBS	EBMT Only	%age	+BBS
devset2 (IWSLT2004)	.3524 [7.7607]	.4910 [7.6240]	70.5	.4063 [8.2176]	.5610 [8.927]	75.3	.4663 [8.8784]
devset3 (IWSLT2005)	.3137 [7.5425]	.4994 [7.8347]	66.0	.3930 [8.1415]	.5450 [8.1934]	72.7	.4411 [8.5965]
devset4 (IWSLT2006)	.1917 [5.5127]	.1537 [2.1997]	38.7	.1828 [5.5208]	.1313 [1.4768]	74.2	.1835 [5.6189]
test (asr 1best)						59.4	.1599 [5.3393]
test (correct)	.1797 [5.4599]					60.6	.1726 [5.6497]