The Open Cantonese Sense-Tagged Corpus

Joanna Ut-Seong Sio and **Luis Morgado da Costa**

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Univerzita Palackého v Olomouci

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- Intro to the Cantonese Wordnet
- Open Cantonese Sense-Tagged Corpus
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  - Methodology
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The Cantonese Wordnet

- It’s an **open** project, **started 2019**, and is ongoing (*slow and steady*)
- Mainly 2 people (with occasional paid help when we have money)
- Cantonese is a widely known Chinese regional variant (**mostly spoken**), close to 80 million speakers worldwide
- Cantonese is fairly large yet **under-resourced** language
- The wordnet currently focuses on **Hong Kong** Cantonese (about 7 m. population)
- Our project is **fully hand-checked**, with a focus on some key linguistic features useful for linguistic analysis (*small and high-quality*)

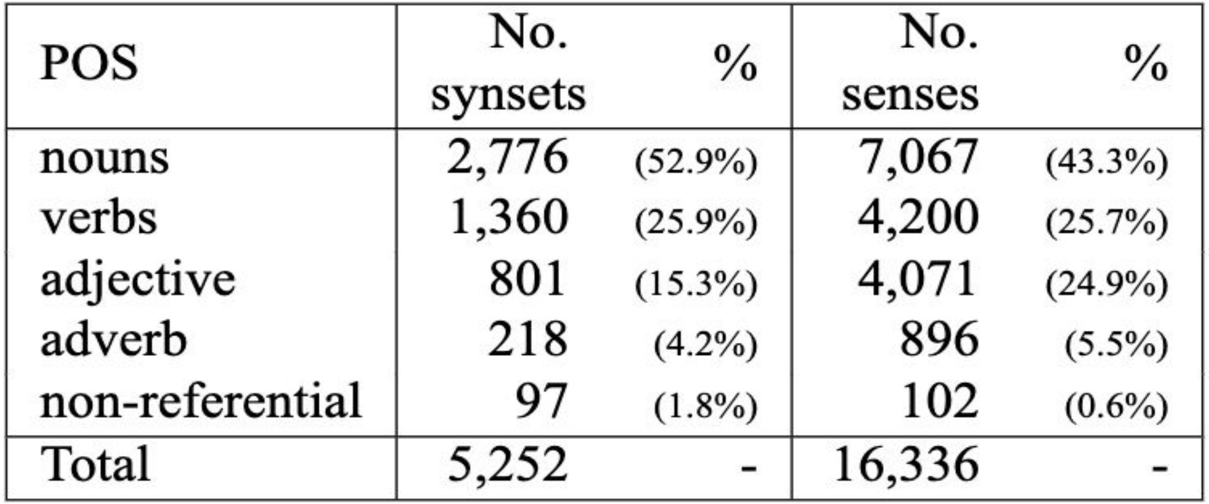
The Cantonese Wordnet

- **STAGE 1 (the first version)**: **characters** (traditional characters); **romanization** (Jyutping, including tonal information), 花, faa1, 'flower'; **expansion approach** using the **Princeton WordNet (PWN) synsets** (provide **definitions**, **semantic hierarchy**, etc.); we try to capture as much **variation** as possible (e.g., multiple characters, lazy pronunciations, etc.) (Sio and Morgado da Costa 2019)

- **STAGE 2**: Initially it was pivoted on the PWN, but is slowly expanding in various directions with added **functional categories** (e.g., classifiers, post-verbal particles) + **example corpus** (Sio and Morgado da Costa 2022)

- **STAGE 3**: Added **sense tagging** (this short paper)

The Cantonese Wordnet



POS	No. synsets	%	No. senses	%
nouns	2,776	(52.9%)	7,067	(43.3%)
verbs	1,360	(25.9%)	4,200	(25.7%)
adjective	801	(15.3%)	4,071	(24.9%)
adverb	218	(4.2%)	896	(5.5%)
non-referential	97	(1.8%)	102	(0.6%)
Total	5,252	-	16,336	-

- The current version of the Cantonese Wordnet contains over 16,000 senses (one sense = character + jyutping, over 32800 forms) distributed over a bit more than 5,000 concepts

Cantonese Wordnet Corpus

Why a new corpus of Cantonese?

- We wanted a corpus to do some types of linguistic research, but:
  - Existing Cantonese corpora are mostly sourced from speech/spoken data ↣ natural (include filler and pauses) but not ideal to extract clean examples
  - Some are made up of texts collected from the Internet, using Cantonese seed words for crawling texts ↣ the text is often a mix of Cantonese and Mandarin
  - Not all are under open license, though some are, e.g., materials in Haambaanglaang.com are all published with a CC-BY licence.
  - Out of the 30 most frequent tokens in the CantoneseWaC (Cantonese Web Corpus), quite a few are strictly non-Cantonese (e.g., 的, 是, 在 and 也)

Cantonese Wordnet Corpus

- **Cantonese Wordnet Corpus**: a corpus of handcrafted examples for individual verb sense, with reference to their compatibility with post-verbal particles

Synset: 00005815-v
Character: 咳

English lemma: cough
Romanization: *kat1*

Example sentence: 一起身咳咗好耐, 所以打電話返公司請假。

↑

- **3,570** hand-crafted example sentences by two native speakers; begin with sentences with *zo2* (perfective aspectual particle)
    - Each sentence has a sense-tagged verb

Word Segmentation

- Cantonese has characters (e.g., 朱古力 ‘chocolate’); segmentation by space would only give you characters
- one character ≠ one word (e.g., 好食 ‘yummy’ [easy-eat], 朱古力 ‘chocolate’, 解決 ‘to solve’)

↣ A word in Cantonese can be represented by 1 or more characters

- Wordhood in Cantonese is problematic: lack of inflectional morphology, little derivational morphology

↣ Hard to decide what is a word or a phrase (compounds vs. phrases)

- Mandarin Chinese word segmentation tools are not suitable for Cantonese.

Word segmentation: ambiguity

- Structural ambiguity in word-segmentation: homographs
  - **Overlapping (crossing) ambiguity**: ABC, if AB and BC are possible 美国会: 美国 ‘American’+会 ‘will/can’ or 美 ‘American'+ 国会 ‘congress’
  - **Combinatorial ambiguity**: AB, if A, B, and AB 才能: 才能 (noun: “talent”), or as the combination of the 才 (adverb: just now) and 能 (verb: able to)
  - **Mixed type:** ABC, if AB and BC, and A or B or C are possible 太平淡 (too dull), 太平 (peaceful), 平淡 (dull), 太 (too/over), 平 (flat), 淡 (plain) are all possible words,

Word Segmentation

What did we do (Huang, Hsieh and Chen 2017) ?

> **Freedom of parts**: If a character can function alone, it is a word; If at least one of a multi-character unit is bound, then it is a word (e.g., 消防員 'fireman').
>
> **Non-compositionality (semantic/structural)**: If the meaning of a multi-character unit is not compositional, it is a word; If the grammatical category of a multi-character unit is different from what one expects (e.g., 擔心 [carry-heart] 'worry', 好食 [good-eat] 'yummy')

There are many other criteria proposed in the literature (some English examples below, Duanmu 2017), but it is not possible to do all the tests while doing sense-tagging.

New York and New Orlean, *New York and Orlean (**Conjunction reduction**)

He lives in the white house, I live in the green one. (**Lexical integrity**)

??He lives in the **White House**, I live in the green one.

Word Segmentation

一日飲八杯水先啱啱好滿足咗人體需要。

“Drinking 8 glasses of water a day exactly satisfies the need of the human body.”

一 // 日 // 飲// 八// 杯// 水// 先// 啱啱好// 滿足// 咗// 人體// 需要

人體: ‘human body’

人 ‘human’: free

體 ‘body’: bound (cannot be used alone)

啱啱好: ‘just right’, ‘exactly’

啱 ‘match’, ‘correct’: free

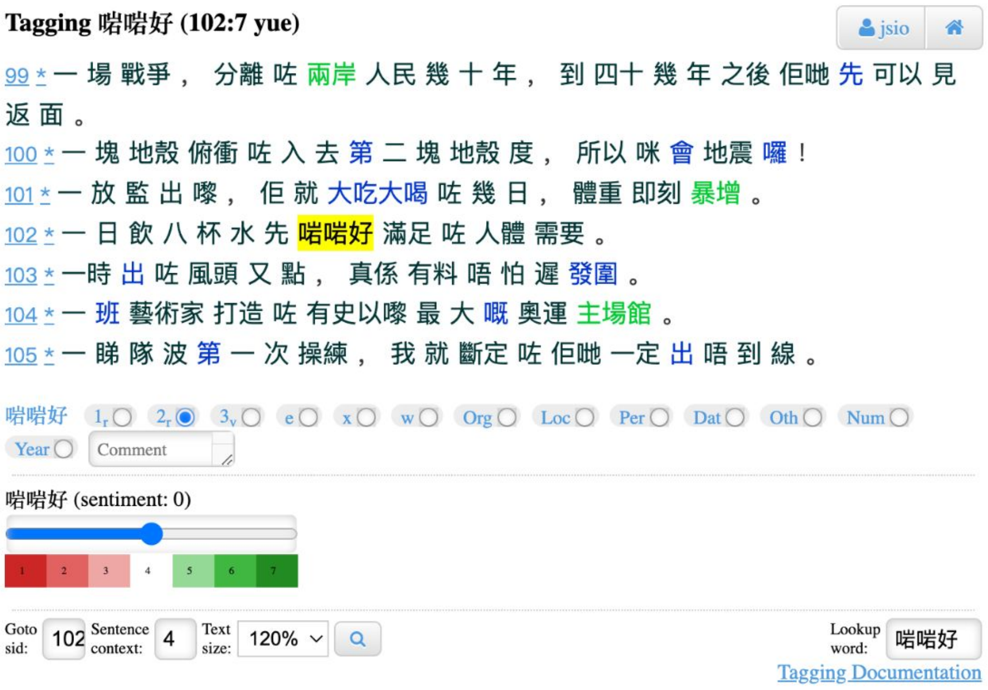
啱啱 ‘exact’: bound

好: ‘good’

Why sense tag?

- There is a **long tradition**, starting with SemCor (10+ languages)
- Helps improve **both the coverage and the precision** of the lexicons being used in the annotation (Miller et al. 1993)
- It helps with a variety of problems/goals:
    - Finding **missing senses**
    - Identifying **indistinguishable definitions**
    - Providing **example sentences**
        - Sense attestation
        - Material for language education
        - Data for WSD and other NLP tasks
- We have only done 300 sentences using **IMI (Bond et al., 2015)**

IMI — A Multilingual Semantic Annotation Environment



Tagging 啱啱好 (102:7 yue)

99 * 一 場 戰爭 ， 分離 咗 兩岸 人民 幾 十 年 ， 到 四十 幾 年 之後 佢哋 先 可以 見 返 面 。

100 * 一 塊 地殼 俯衝 咗 入 去 第 二 塊 地殼 度 ， 所以 咪 會 地震 囉 ！

101 * 一 放 監 出 嚟 ， 佢 就 大吃大喝 咗 幾 日 ， 體重 即刻 暴增 。

102 * 一 日 飲 八 杯 水 先 啱啱好 滿足 咗 人體 需要 。

103 * 一時 出 咗 風頭 又 點 ， 真係 有料 唔 怕 遲 發圍 。

104 * 一 班 藝術家 打造 咗 有史以嚟 最 大 嘅 奧運 主場館 。

105 * 一 睇 隊 波 第 一 次 操練 ， 我 就 斷定 咗 佢哋 一定 出 唔 到 線 。

啱啱好 1_r ○ 2_r ● 3_v ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○ Comment

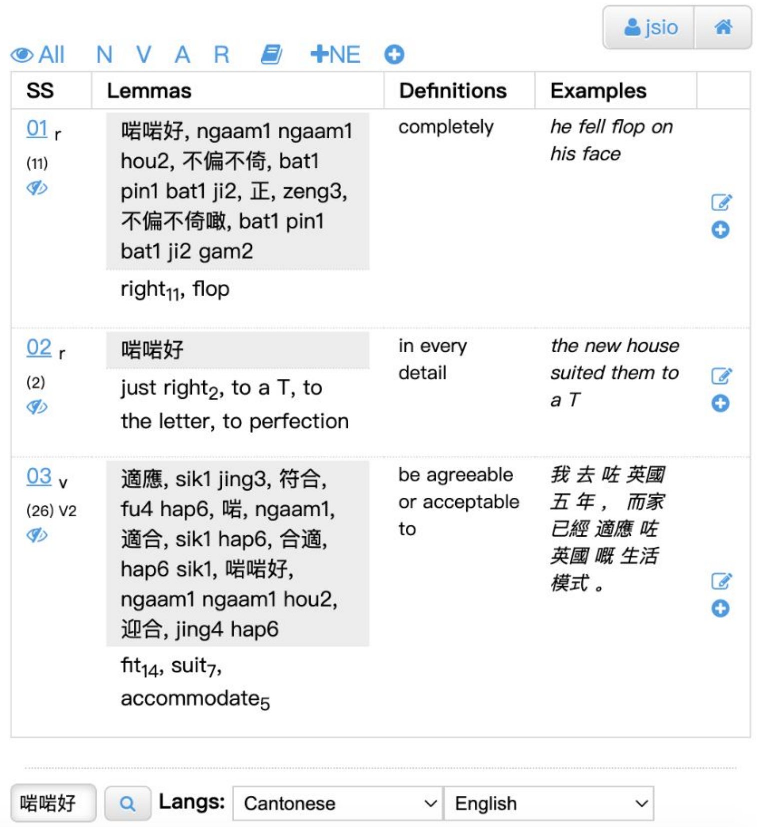
啱啱好 (sentiment: 0)

Goto sid: 102 Sentence context: 4 Text size: 120%

Lookup word: 啱啱好

Tagging Documentation

Senses **not** ordered by frequency



SS	Lemmas	Definitions	Examples	
01 r (11)	啱啱好, ngaam1 ngaam1 hou2, 不偏不倚, bat1 pin1 bat1 ji2, 正, zeng3, 不偏不倚噉, bat1 pin1 bat1 ji2 gam2 right$_{11}$, flop	completely	*he fell flop on his face*	
02 r (2)	啱啱好 just right$_{2}$, to a T, to the letter, to perfection	in every detail	*the new house suited them to a T*	
03 v (26) V2	適應, sik1 jing3, 符合, fu4 hap6, 啱, ngaam1, 適合, sik1 hap6, 合適, hap6 sik1, 啱啱好, ngaam1 ngaam1 hou2, 迎合, jing4 hap6 fit$_{14}$, suit$_{7}$, accommodate$_{5}$	be agreeable or acceptable to	*我 去 咗 英國 五 年 ， 而家 已經 適應 咗 英國 嘅 生活 模式 。*	

啱啱好 Langs: Cantonese English

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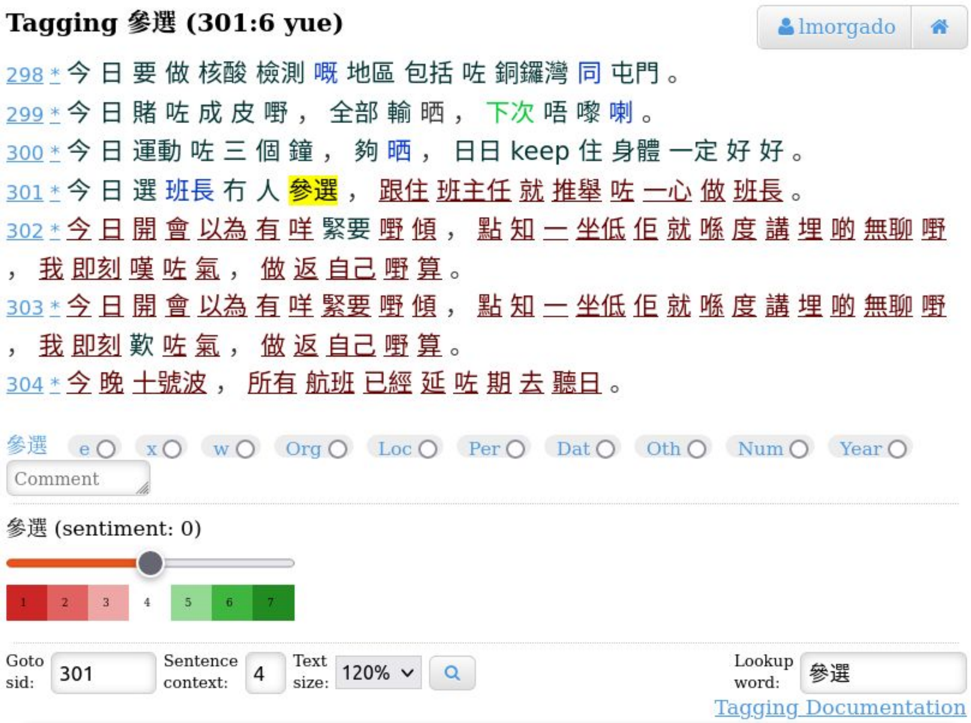

Tagging 參選 (301:6 yue)

298 * 今 日 要 做 核酸 檢測 嘅 地區 包括 咗 銅鑼灣 同 屯門 。

299 * 今 日 賭 咗 成 皮 嘢 ， 全部 輸 晒 ， 下次 唔 嚟 喇 。

300 * 今 日 運動 咗 三 個 鐘 ， 夠 晒 ， 日日 keep 住 身體 一定 好 好 。

301 * 今 日 選 班長 冇 人 參選 ， 跟住 班主任 就 推舉 咗 一心 做 班長 。

302 * 今 日 開 會 以為 有 咩 緊要 嘢 傾 ， 點 知 一 坐低 佢 就 喺 度 講 埋 啲 無聊 嘢 ， 我 即刻 嘆 咗 氣 ， 做 返 自己 嘢 算 。

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304 * 今 晚 十號波 ， 所有 航班 已經 延 咗 期 去 聽日 。

參選 e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

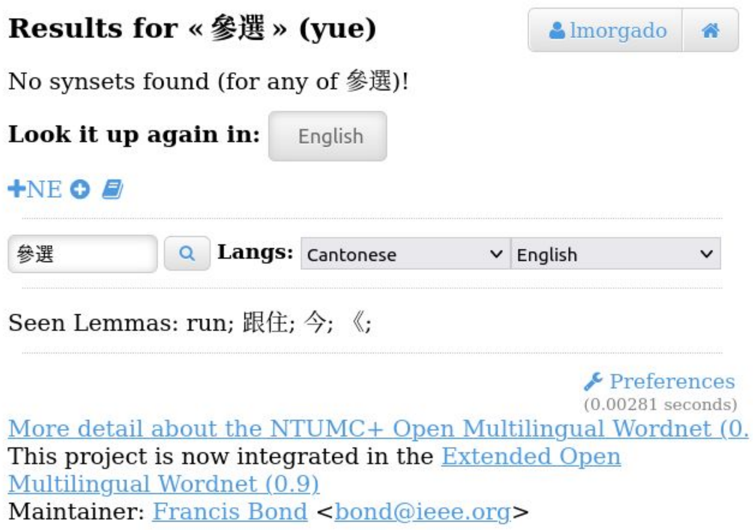
Comment

參選 (sentiment: 0)

Goto sid: 301 Sentence context: 4 Text size: 120%

Lookup word: 參選

Tagging Documentation



Results for « 參選 » (yue)

No synsets found (for any of 參選)!

Look it up again in: English

參選 **Langs:** Cantonese English

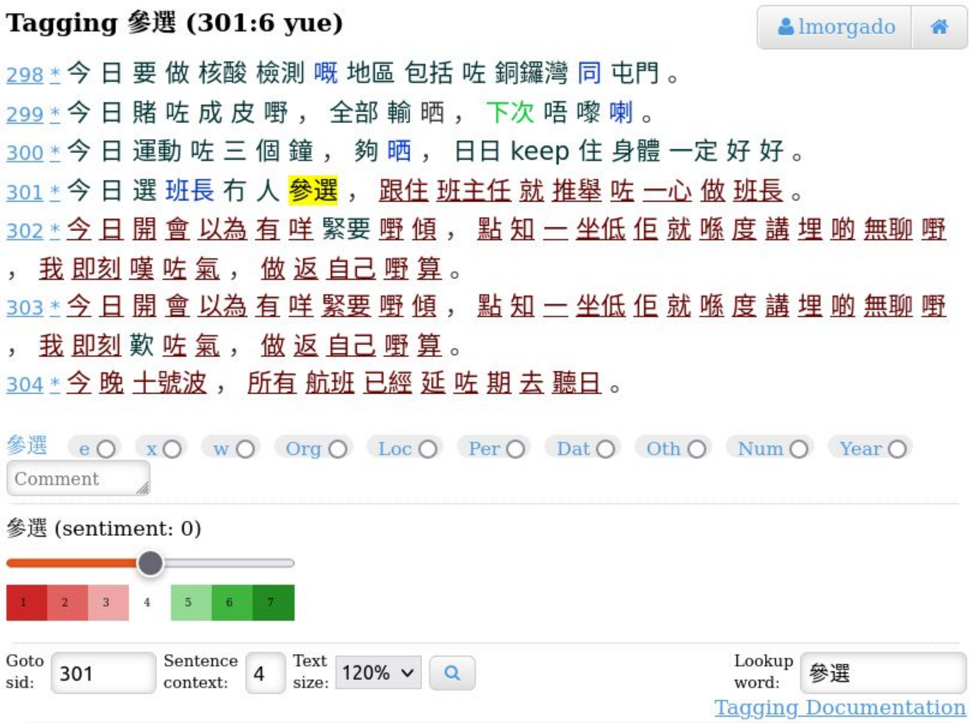
Seen Lemmas: run; 跟住; 今; 《;

Preferences
(0.00281 seconds)

More detail about the NTUMC+ Open Multilingual Wordnet (0.
This project is now integrated in the Extended Open Multilingual Wordnet (0.9)
Maintainer: Francis Bond <bond@ieee.org>

Adding new senses on the fly

IMI — A Multilingual Semantic Annotation Environment



Tagging 參選 (301:6 yue)

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參選 e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

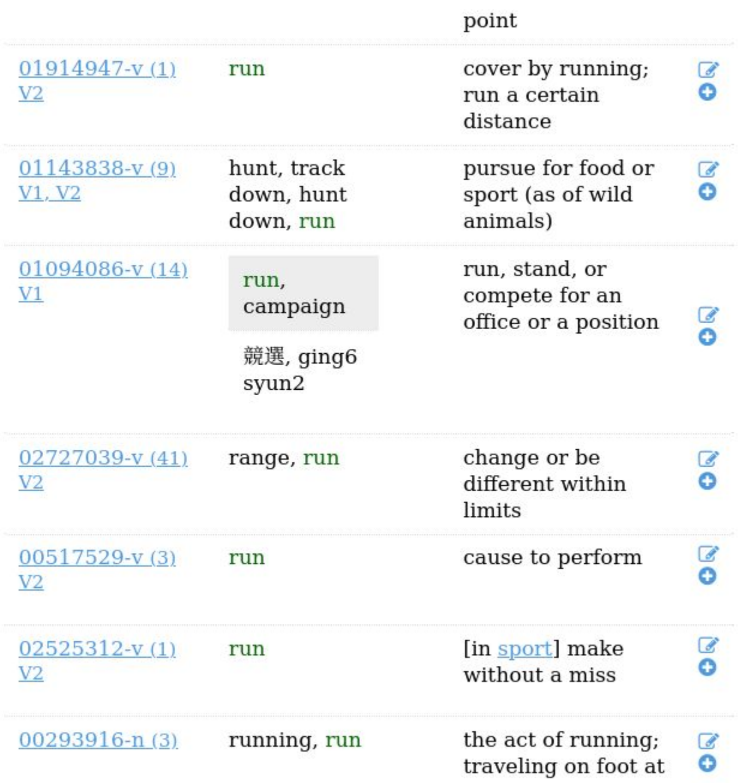
Comment

參選 (sentiment: 0)

Goto sid: 301 Sentence context: 4 Text size: 120%

Lookup word: 參選

Tagging Documentation



		point	
01914947-v (1) V2	run	cover by running; run a certain distance	
01143838-v (9) V1, V2	hunt, track down, hunt down, run	pursue for food or sport (as of wild animals)	
01094086-v (14) V1	run, campaign 競選, ging6 syun2	run, stand, or compete for an office or a position	
02727039-v (41) V2	range, run	change or be different within limits	
00517529-v (3) V2	run	cause to perform	
02525312-v (1) V2	run	[in sport] make without a miss	
00293916-n (3)	running, run	the act of running; traveling on foot at	

Adding new senses on the fly

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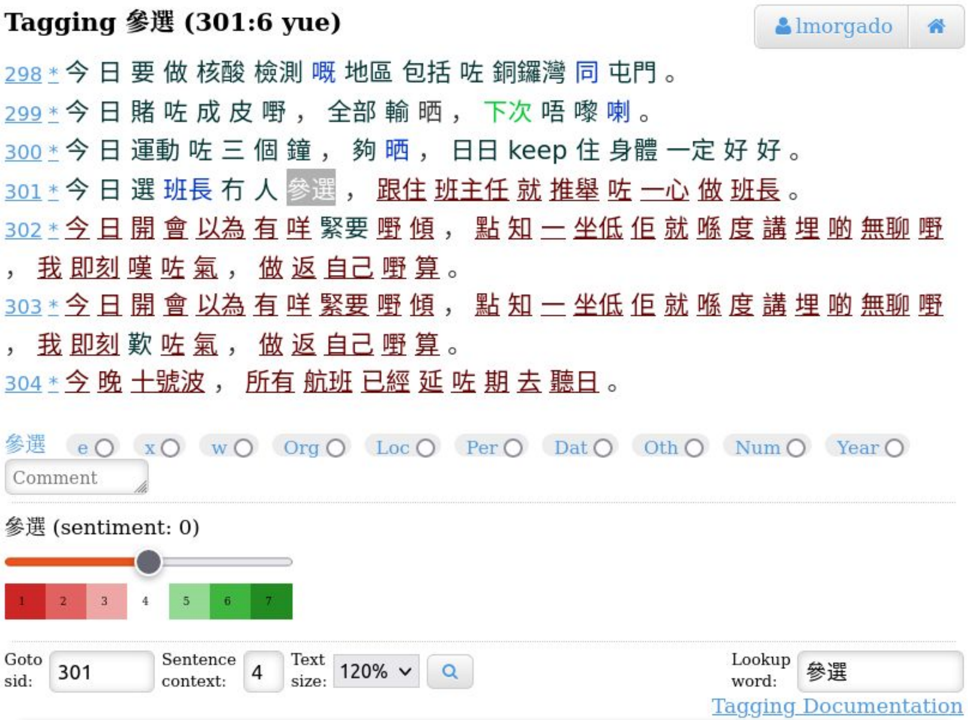

Tagging 參選 (301:6 yue)

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參選 e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

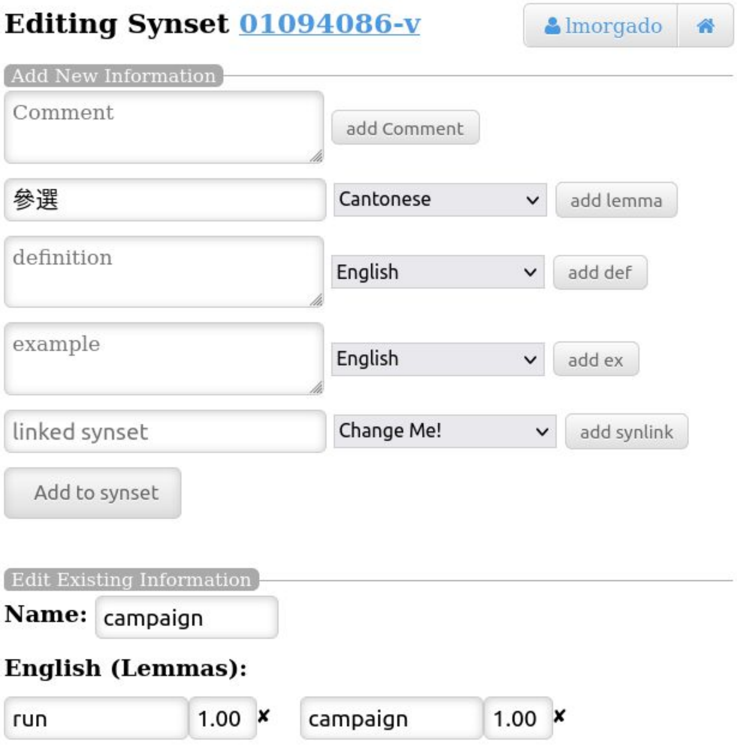
Comment

參選 (sentiment: 0)

1	2	3	4	5	6	7

Goto sid: 301 Sentence context: 4 Text size: 120% Lookup word: 參選

Tagging Documentation



Editing Synset 01094086-v

Add New Information

Comment — add Comment

參選 — Cantonese — add lemma

definition — English — add def

example — English — add ex

linked synset — Change Me! — add synlink

Add to synset

Edit Existing Information

Name: campaign

English (Lemmas):

run 1.00 ✗ campaign 1.00 ✗

Adding new senses on the fly

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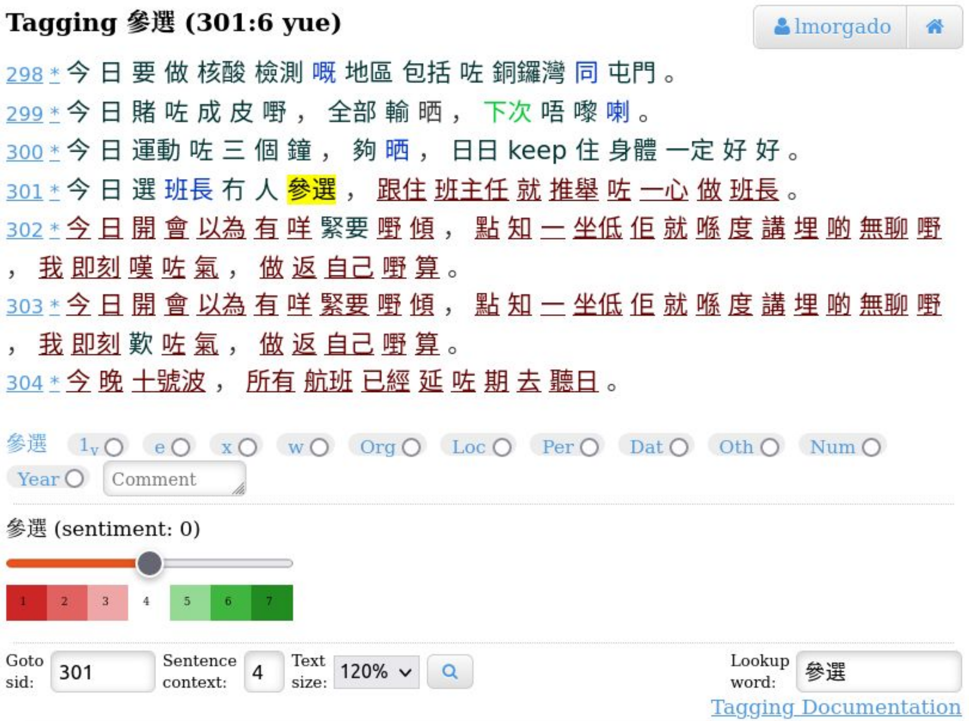

Tagging 參選 (301:6 yue)

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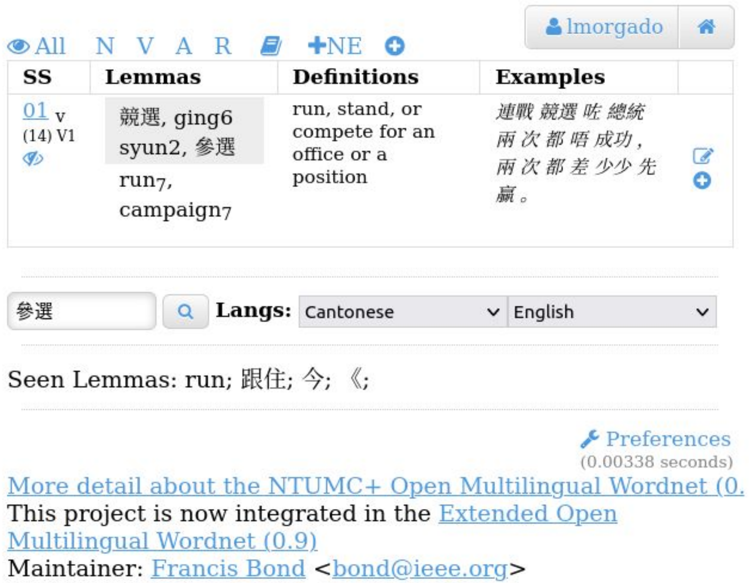
參選 1_v ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○ Comment

參選 (sentiment: 0)

1 2 3 4 5 6 7

Goto sid: 301 Sentence context: 4 Text size: 120% Lookup word: 參選

Tagging Documentation



SS	Lemmas	Definitions	Examples	
01 v (14) V1	競選, ging6 syun2, 參選 run7, campaign7	run, stand, or compete for an office or a position	*連戰 競選 咗 總統 兩 次 都 唔 成功 , 兩 次 都 差 少少 先 贏 。*	

參選 Langs: Cantonese English

Seen Lemmas: run; 跟住; 今; 《;

Preferences
(0.00338 seconds)

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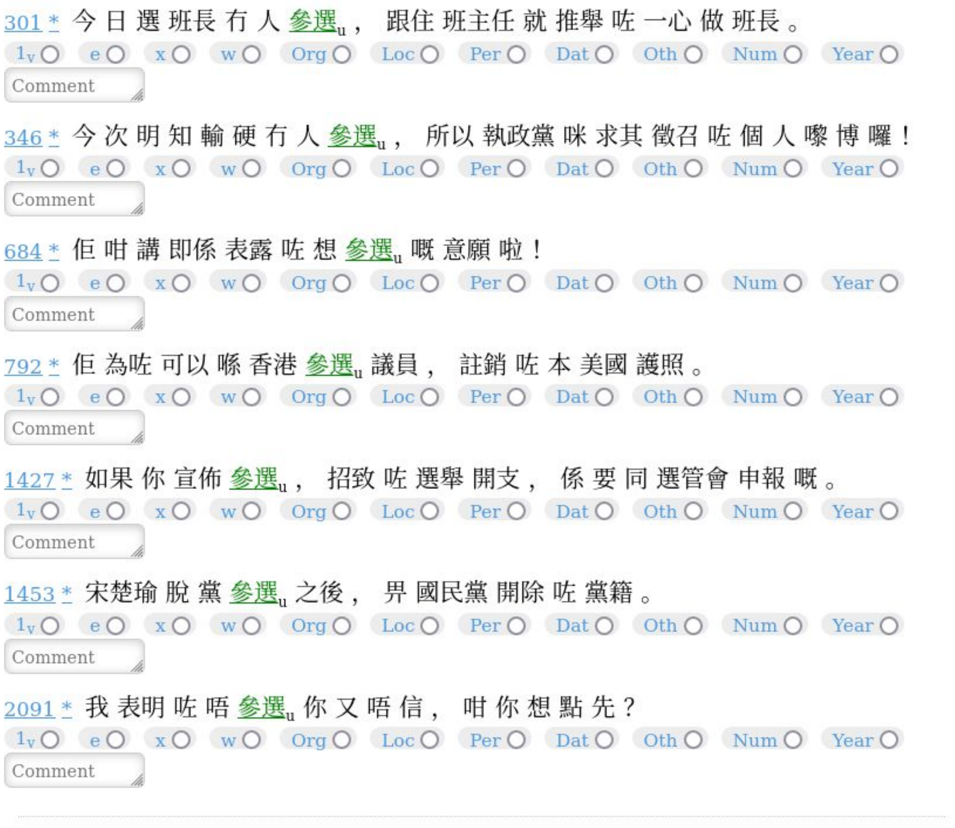


301 * 今 日 選 班長 冇 人 參選$_u$， 跟住 班主任 就 推舉 咗 一心 做 班長 。

1$_v$ ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

Comment

346 * 今 次 明 知 輸 硬 冇 人 參選$_u$， 所以 執政黨 咪 求其 徵召 咗 個 人 嚟 博 囉 !

1$_v$ ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

Comment

684 * 佢 咁 講 即係 表露 咗 想 參選$_u$ 嘅 意願 啦 !

1$_v$ ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

Comment

792 * 佢 為咗 可以 喺 香港 參選$_u$ 議員， 註銷 咗 本 美國 護照 。

1$_v$ ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

Comment

1427 * 如果 你 宣佈 參選$_u$， 招致 咗 選舉 開支， 係 要 同 選管會 申報 嘅 。

1$_v$ ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

Comment

1453 * 宋楚瑜 脫 黨 參選$_u$ 之後， 畀 國民黨 開除 咗 黨籍 。

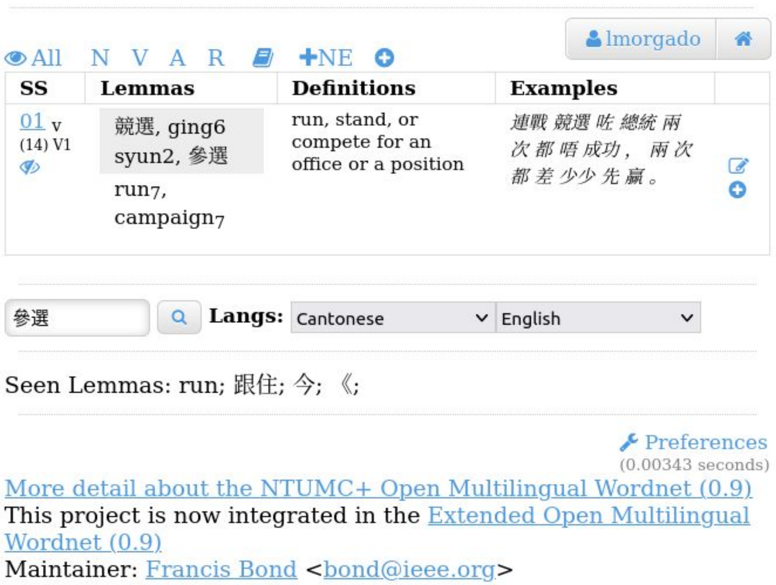
1$_v$ ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

Comment

2091 * 我 表明 咗 唔 參選$_u$ 你 又 唔 信， 咁 你 想 點 先 ?

1$_v$ ○ e ○ x ○ w ○ Org ○ Loc ○ Per ○ Dat ○ Oth ○ Num ○ Year ○

Comment



SS	Lemmas	Definitions	Examples
01 v (14) V1	競選, ging6 syun2, 參選 run$_7$, campaign$_7$	run, stand, or compete for an office or a position	連戰 競選 咗 總統 兩 次 都 唔 成功， 兩 次 都 差 少少 先 贏 。

參選 Langs: Cantonese English

Seen Lemmas: run; 跟住; 今; 《;

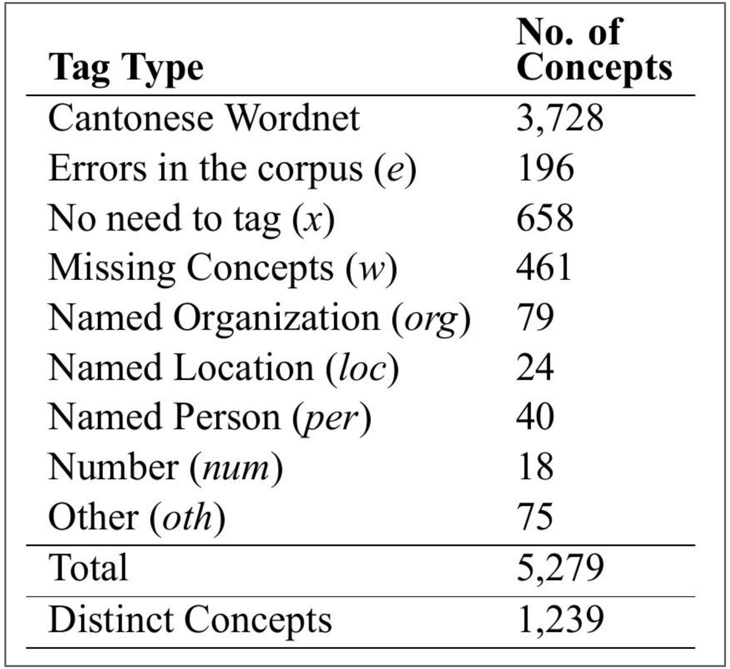
Preferences
(0.00343 seconds)

More detail about the NTUMC+ Open Multilingual Wordnet (0.9)
This project is now integrated in the Extended Open Multilingual Wordnet (0.9)
Maintainer: Francis Bond <bond@ieee.org>

Tagging all instances of a lemma is possible – future work

Summary of Results

- 300 sentences
- 5,279 candidate senses
  - 3,728 senses linked to the CantoneseWN
  - 1,239 distinct concepts
    - 709 new senses
- 162 Named Entities/Numbers
- 461 instances of missing concepts
- 196 instances of segmentation problems/MWEs
- 75 *Other*/FW (in 300 sentences)



Tag Type	**No. of Concepts**
Cantonese Wordnet	3,728
Errors in the corpus (*e*)	196
No need to tag (*x*)	658
Missing Concepts (*w*)	461
Named Organization (*org*)	79
Named Location (*loc*)	24
Named Person (*per*)	40
Number (*num*)	18
Other (*oth*)	75
Total	5,279
Distinct Concepts	1,239

Issues

- **Missing concepts**: 籤 ‘fortune telling stick’, 利是 ‘red pocket’, 成 sing4 10%
- **Different levels of specification**: 多 ‘much’ or ‘many’; ‘佢’ 3sG ‘he/she/it’
- **Separable verbs**:

  跳舞 ‘dance a dance/dance’ + 咗: perfective marker ➳ 跳咗舞 (compositional)

  挖角 ‘headhunt’ + 咗: perfective marker ➳ 挖咗角 (non-compositional)
- **Mixed code**: ‘Meet 到 target’; 到: succeed in reaching the destination; O 唔 OK ‘is it okay or not?’
- **Errors in segmentation**: ‘今日’ today ➳ ‘今’ + ‘日’ this + day

  (evidence: 今個月 ‘this month’, [this-classifier-month])

Future Work

- Multiple suitable senses for a single concept
  - Allowing ambiguity
  - Finding coarser senses
  - This requires some changes in the annotation tools (allow tagging multiple senses at least temporarily)
- Expand the corpus with other genres
  - We are working with *Hambaanglaang* and *Tatoeba* (graded educational materials)
- Add missing Cantonese-specific concepts (waiting for CILI)

Future Work

- Collaboration with colleagues in Hong Kong (Hong Kong Education University, the Chinese University of Hong Kong) and Vancouver (University of British Columbia)
    - Crowdsourcing data
    - Focus on Cantonese Education

- Use sense-tagging in Cantonese language classrooms (Bond et al., 2021)

Releasing our Data

- The Cantonese Wordnet, Example Corpus, and Sense Annotation will all be released under a Creative Commons Attribution 4.0 International License (CC BY).
- You will be able to download this data from its Github repository:

https://github.com/lmorgadodacosta/CantoneseWN

  - Wordnet LMF (OMW 2.0)
  - TSV (OMW 1.0)

Contacts:

Joanna Ut-Seong Sio joannautseong.sio@upol.cz

Luis Morgado da Costa lmorgado.dacosta@gmail.com

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thank you