Subsegmental language detection in Celtic language text

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Special thanks to
Kevin Scannell

Introduction

We aim to perform language identification on sub segmental basis:

- Typical case is to detect the language of documents and sentences.
- We are focussing on cases where - A single sentence may have different code switching points

Dataset

- Simplifying the task by taking into account Celtic languages and a corresponding majority language.
- Manual annotation of about 40-50 tweets for each of the three language pairs.

Pair	Language	Statistics (%)	
		Tokens	Segments
Irish—English	Irish	332	40
	English	379	42
Welsh—English	Welsh	419	64
	English	378	66
Breton—French	Breton	388	54
	French	379	53

Methodology

. . . . . Alphabet n-gram approach . . . . . .

- Character Language model
- Using IRSTLM we build a language model for the five languages
- For English and French - Europarl
- Breton, Welsh and Irish - Corpora of text crawled from the web
- Size of the corpus from which this language model was built - 1.5 million tokens
- Example - the word ‘sláinte!’ would be broken down into a sequence of {‘_ s’, ‘s l’, ‘l á’, ‘á i’, ‘i n’, ‘n t’, ‘t e’, ‘e !’, ‘! _’}.

. . . . . Word based prediction . . . . . .

- Generate word lists for the languages using aspell which is widely used on Unix systems.
- Word are labeled according to their presence in the particular word list.
- In case of a confusion the word is added to the previous segment

. . Word-based prediction with character backoff . .

- Same as Word-based prediction, but in case of confusion this falls back to the Alphabet bi-gram approach.

. . . . . Baseline . . . . . .

- Using langid.py labeled all the lines in a particular dataset according to the majority classification

. . . . . Langid character trigram prediction . . . . . .

- Trigram probabilities from langid were taken into account.
- All other heuristics and chunking algorithm are same as for other methods.

Example

[**en** You’re a] [**ga** Meiriceánach, cén fáth] [**en** are you] [**ga** foghlaim Gaeilge?!]
@afaltomkins [**cy** gorfod cael bach o tan] [**en** though init]
en omg[**cy** mar cwn bach yn] [**en** black and tan] [**cy** a popeth,] [**en** even cuter!!]

Code switching: You’re a [Meiriceánach, cén fáth] are you [foghlaim Gaeilge?!]
Quotations: The anthem starts with the words [‘Mae hen wlad fy nhadau…’]
Named entities: [Dr Jekyll] ha [Mr Hyde] embannet gant [Éditions Aber]
Interjections: Hey, that’s great, [diolch yn fawr!]
Translations: Bloavezh mat d’an holl ! [Bonne anné à tous !]

Chunking algorithm

Algorithm 1 *

Require: s : sentence to chunk

buffer = [ ] /*Undecided expanding window of chunk*/
chunks = [ ] /*Decided labelled segment*/
buffer_language ← LangPredict(s[0]) /* Language of first word */
flag ← 0
for all $w \in s$ **do**
  if LangPredict(w)=buffer_language **then**
    if flag = 1 **then**
      buffer ← buffer + [word_buffer,w]
      flag ← 0
    else
      buffer ← buffer + [w]
  if LangPredict(w) $\neq$buffer_language **then**
    if flag= 0 **then**
      flag ← 1
      word_buffer ← w
      continue
    else
      chunks ← chunks + [(buffer,buffer_language)]
      buffer ← [word_buffer,w]
      buffer_language ← LangPredict(w)
      flag ← 0
if length(buffer) $\neq$0 **then**
  chunks ← chunks + [(buffer,buffer_language)]

Results

System		Irish—English		Welsh—English		Breton—French	
		Irish	English	Welsh	English	Breton	French
`baseline`	p	2.50	0.0	0.0	0.0	0.0	0.0
	r	2.56	0.0	0.0	0.0	0.0	0.0
`langid-3character`	p	5.00	14.29	0.0	21.21	1.85	20.75
	r	5.41	8.45	0.0	14.58	1.92	12.36
`wordlist`	p	32.50	28.57	26.69	**40.91**	57.41	33.96
	r	23.64	26.09	**26.03**	**33.75**	47.69	33.33
`character bigram`	p	32.50	35.71	23.44	19.70	57.41	52.83
	r	22.41	26.79	15.31	16.67	41.33	37.84
`wordlist+character bigram`	p	**52.50**	**50.00**	**32.81**	31.82	**70.37**	**67.92**
	r	**38.18**	**43.75**	24.14	25.61	**57.58**	**57.14**

System	Accuracy (%)		
	Irish—English	Welsh—English	Breton—French
`baseline`	42.76	42.16	44.07
`langid-3character`	57.24	45.92	43.16
`wordlist`	79.75	**74.28**	83.96
`character bigram`	81.29	65.62	76.79
`wordlist+character bigram`	**85.79**	72.40	**88.79**

Evaluation

- We followed the footsteps of CoNLL 2000 shared task on language independent named entity recognition.
- Divide the text into non-overlapping segments.
- Precision - percentage of correctly detected phrases.
- Recall - number of phrases in the data that were found by the chunker.

Conclusions

- A very preliminary investigation into subsegment language identification in Celtic language texts.
- We would like to include supervised methods and features talked about by King and Abney (2013)
- We would also like to check our methods with higher order n-grams and more options in backoff.
- Explore a lattice technique where each word is a lattice node and the inclusions of the words are done using probability.