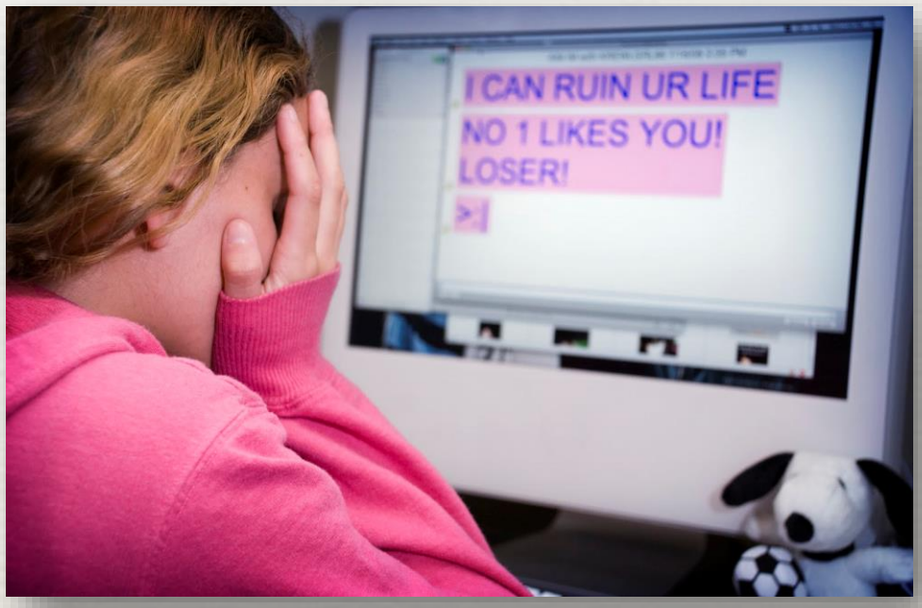
Brute Force Works Best Against Bullying

Michal Ptaszynski, Fumito Masui, Yasutomo Kimura,
Rafal Rzepka and Kenji Araki

Outline

1. Cyberbullying as social problem
2. Previous research
3. Proposed method
4. Experiments
5. Future work

Introduction



Cyberbullying

- Slandering and humiliating people on the Internet.
- Recently noticed social problem.

HELP by ICT

INTERNET PATROL

- Internet monitoring by PTA.
- Request site admin to remove harmful entries.
- High cost of time and fatigue for net-patrol members.

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Dataset

- Actual data collected by Internet Patrol (annotated by experts)
- From unofficial school forums (BBS)
- Provided by Human Right Center in Japan (Mie Prefecture)
- According to the Definition by Japanese Ministry of Education (MEXT)
- 1,490 harmful and 1,508 non-harmful entries

Proposed Method

Language Combinatorics

SPEC – Sentence Pattern Extraction arChitecture

Sentence patterns = ordered non-repeated combinations of sentence elements.

for $1 \leq k \leq n$, there is $\binom{n}{k} = \frac{n!}{k!(n-k)!}$ all possible *k*-long patterns, and

$$\sum_{k=1}^{n} \binom{n}{k} = \frac{n!}{1!(n-1)!} + \frac{n!}{2!(n-2)!} + \ldots + \frac{n!}{n!(n-n)!} = 2^n - 1$$

Extract patterns from all sentences and calculate occurrence.

Michal Ptaszynski, R. Rzepka, K. Araki and Y. Momouchi. 2011. **Language combinatorics: A sentence pattern extraction architecture based on combinatorial explosion.** *Int. J. of Computational Linguistics (IJCL)*, Vol. 2, Issue 1, pp. 24-36.

Language Combinatorics

Example: What a nice day !

That is why “brute force”

5-element pattern: What a nice day ! (1)

4-el. patterns:	3-el. patterns:	2-el. patterns:	1-el. patterns:
What a nice * !	a nice * !	What a	What
What a nice day	What a nice	What * !	a
What a * day !	What a * !	nice * !	nice
(5)	(10)	(10)	(5)
.	.	.	.
.	.	.	.
.	.	.	.

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Normalized pattern weight $w_j = \left(\frac{O_{pos}}{O_{pos} + O_{neg}} - 0.5 \right) * 2$

Score for one sentence $score = \sum w_j, (1 \geq w_j \geq -1)$

Classify new input with pattern list

M[illegible]K. Araki and Y. Momouchi. 2011. **Language combinatorics: A sentence pattern extraction architecture based on combinatorial explosion.** *Int. J. of Computational Linguistics (IJCL)*, Vol. 2, Issue 1, pp. 24-36.

Experiment setup

Preprocessing
1. Tokenization
2. POS
3. Tokens+POS

Pattern List Modification

1. All patterns
2. Zero-patterns deleted
3. Ambiguous patterns deleted

Weight Calculation Modifications

1. Normalized
2. Award length
3. Award length and occurrence

All patterns vs. only n-grams

Automatic threshold setting

10-fold Cross Validation

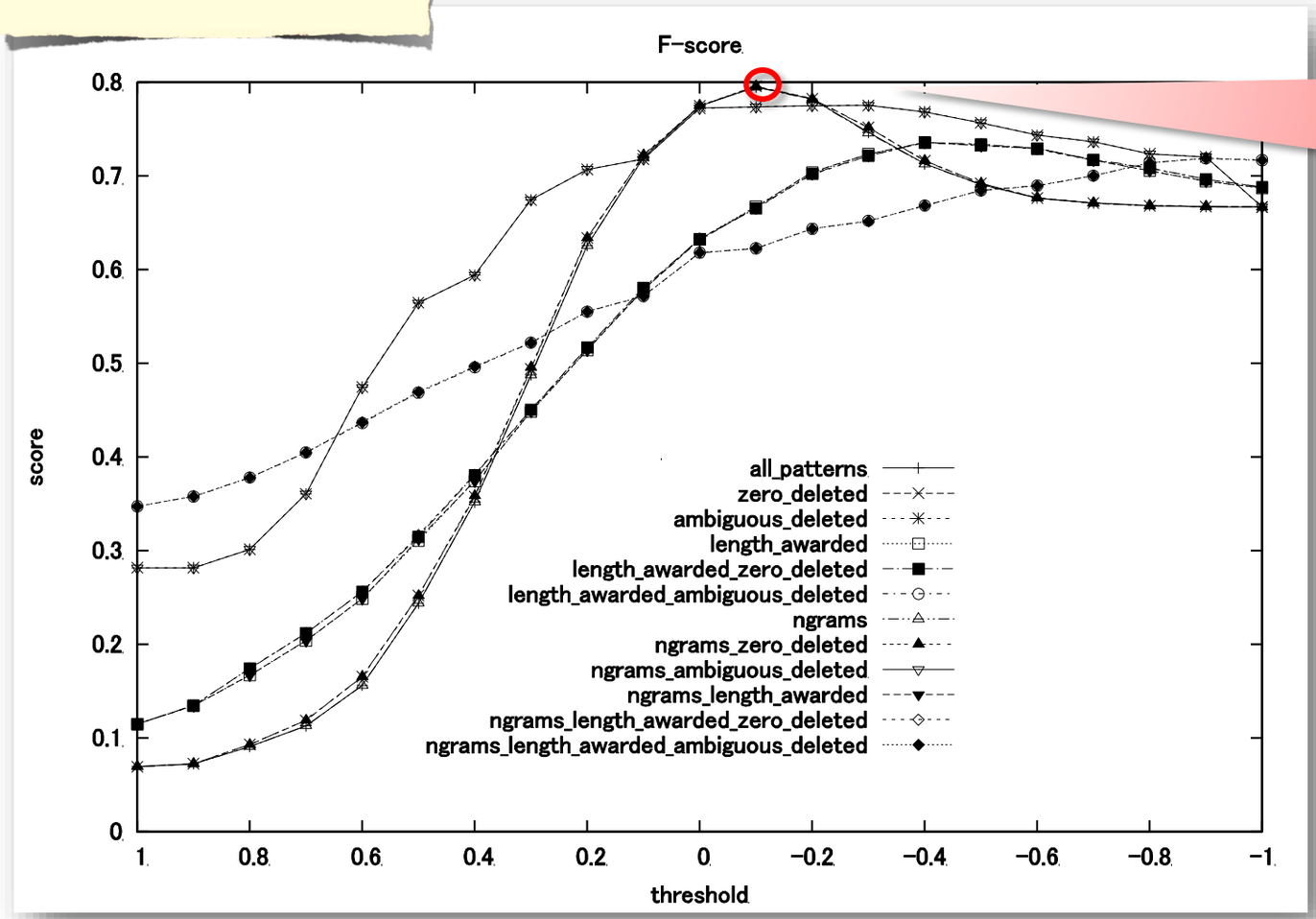
Is it worth the time?

One experiment = 420 runs

Data is never perfectly balanced.

Results

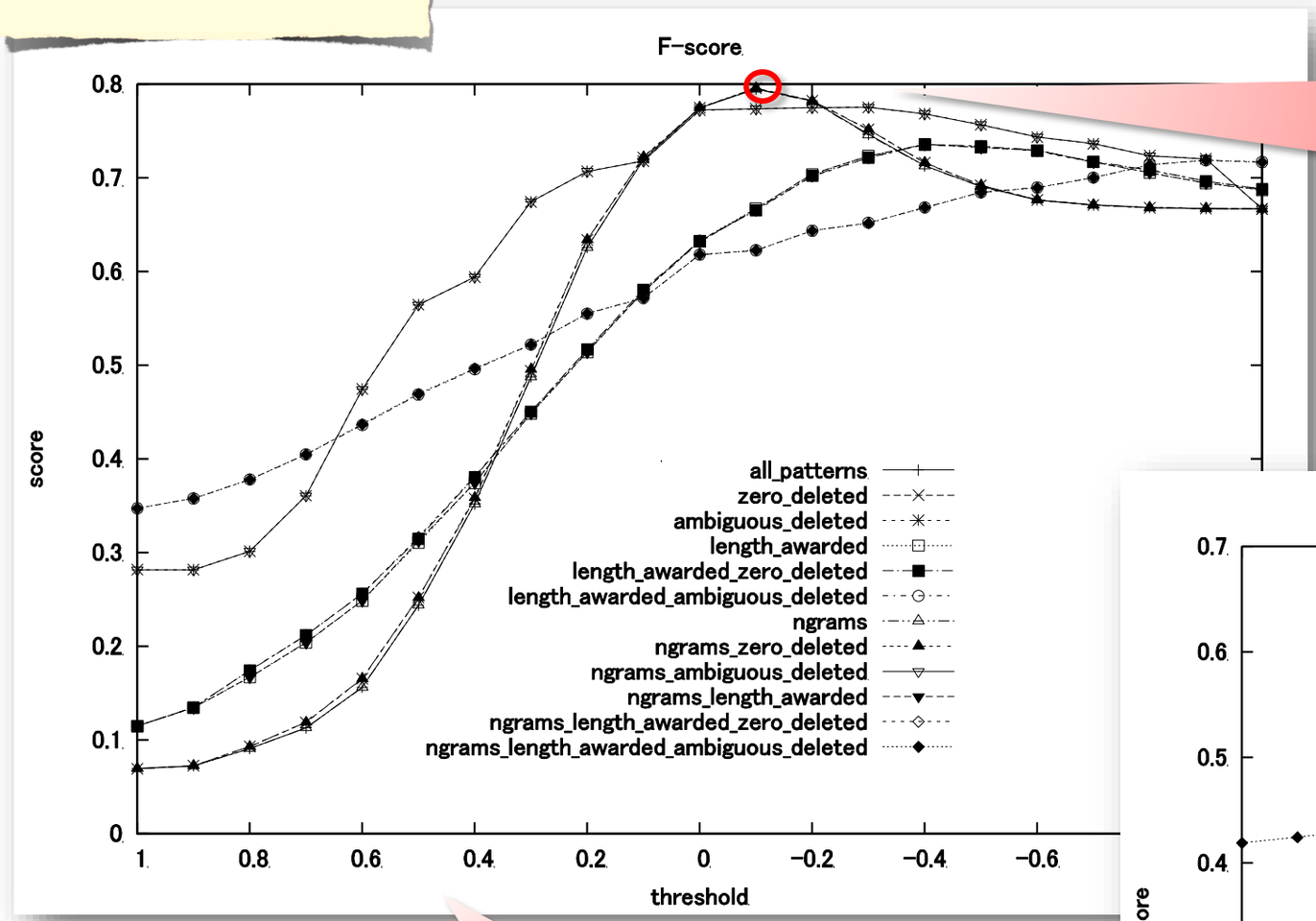
Tokens+POS



Best F-score
F=0.8
P=0.76
R=0.84

Results

Tokens+POS



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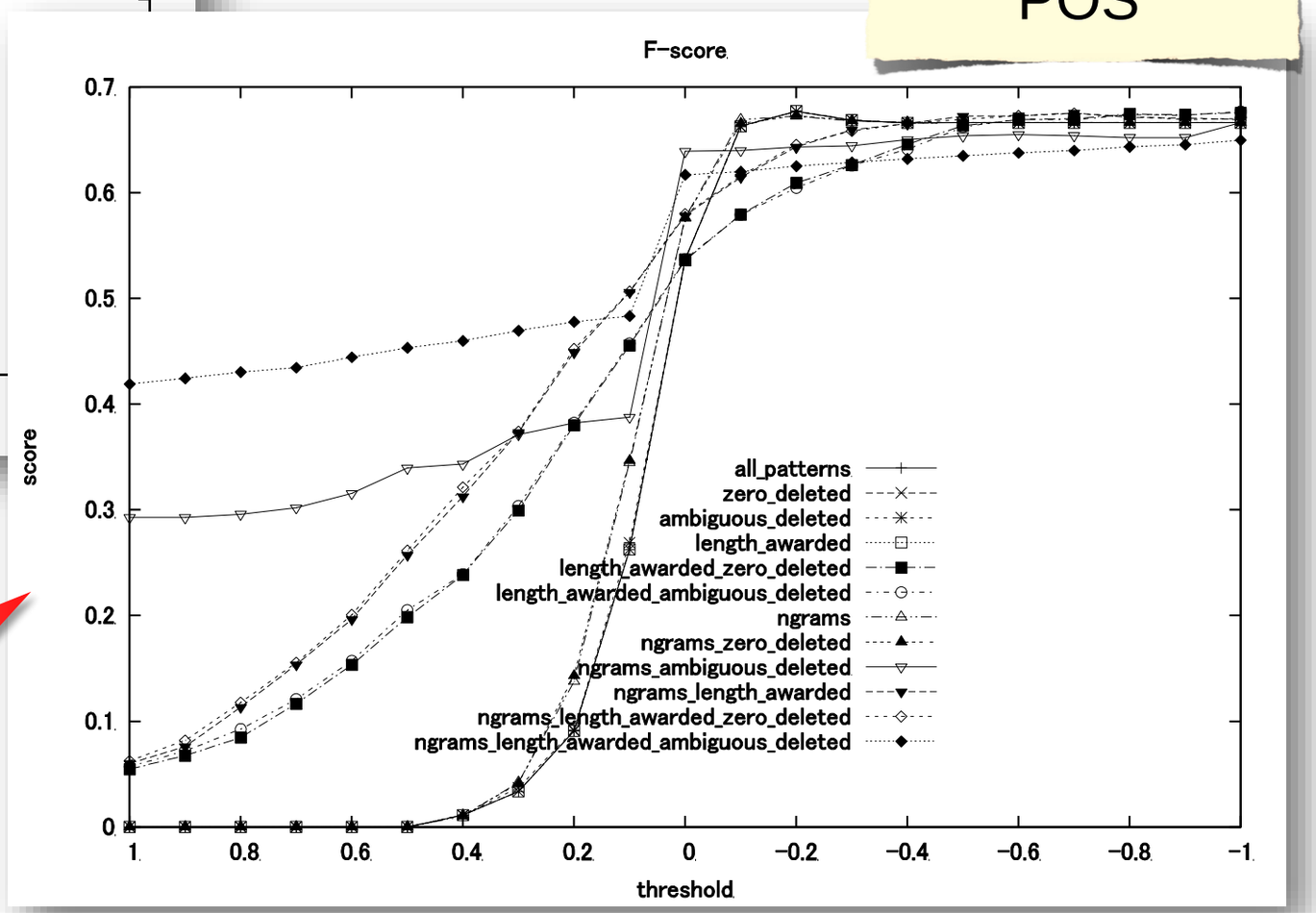
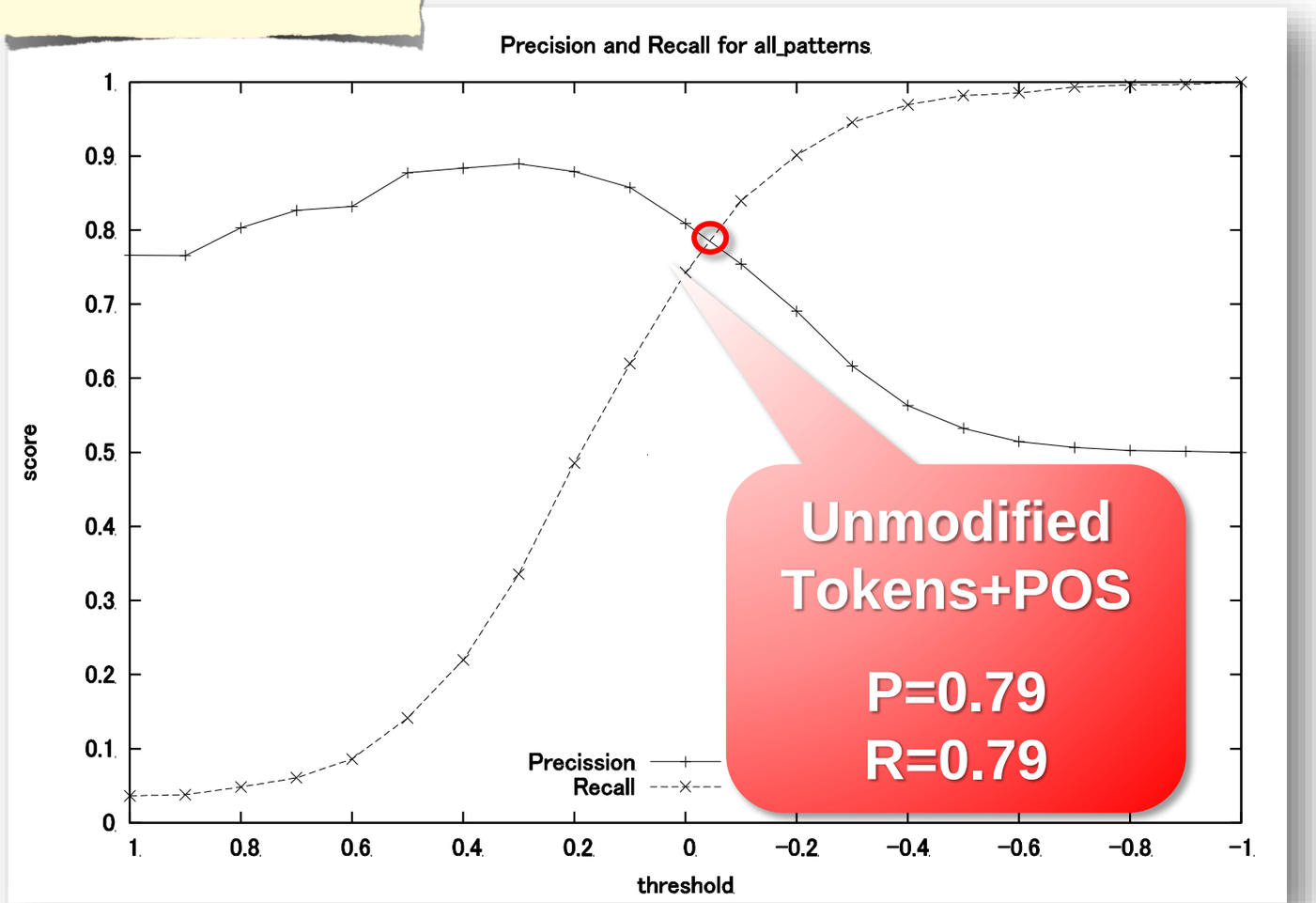


specific elements are more effective than generalized ones

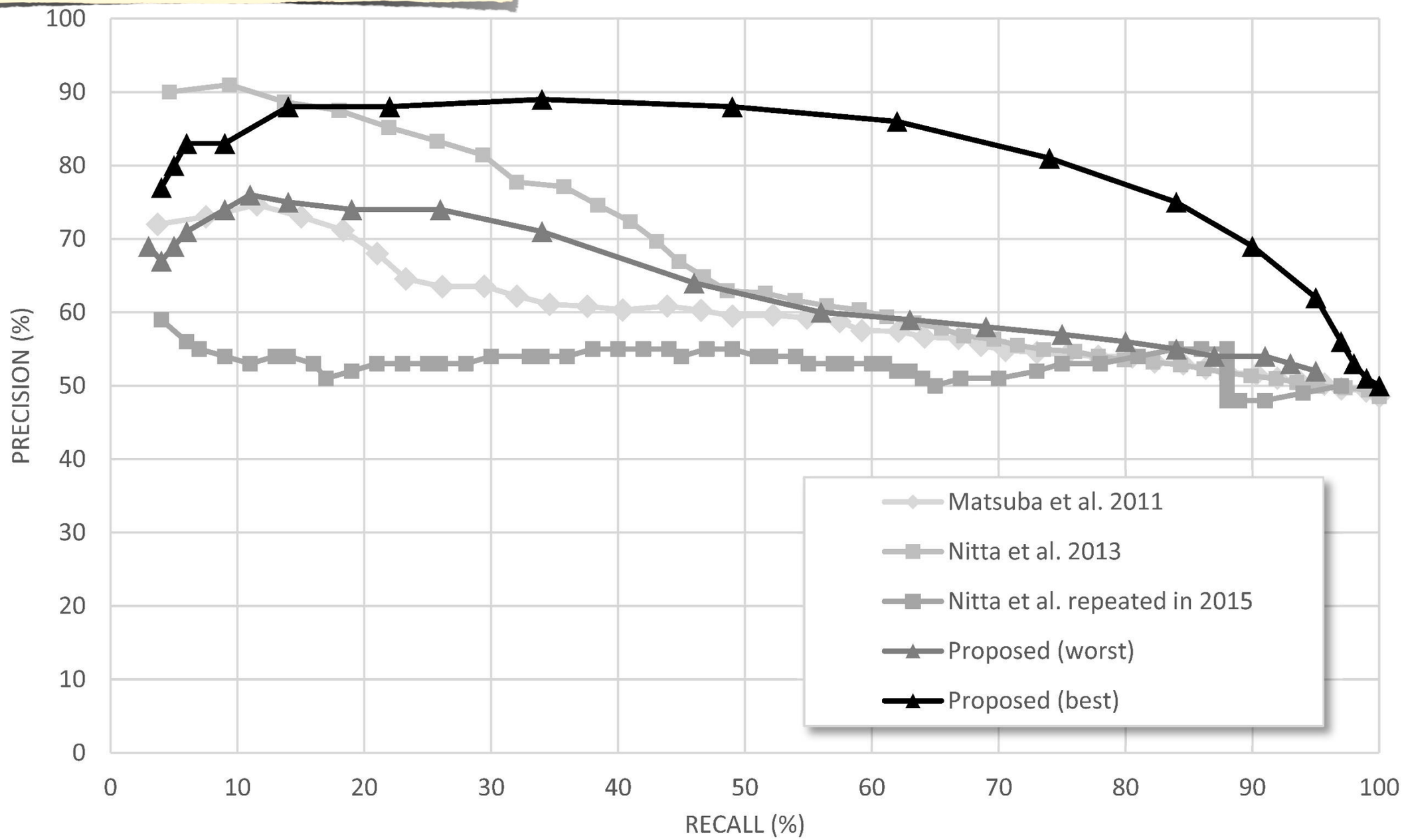
Results

Best BEP



Results

Comparison with state-of-the-art



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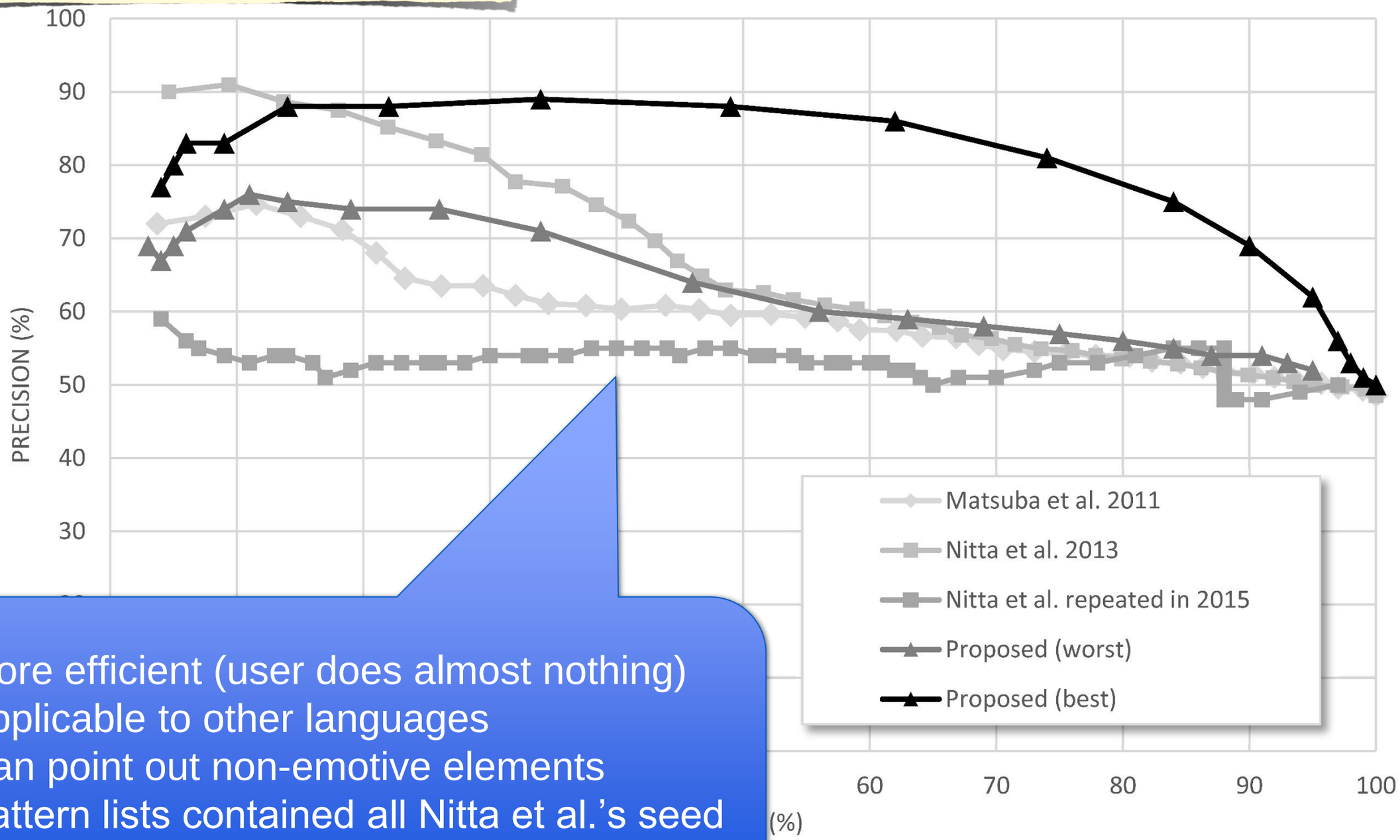

- More efficient (user does almost nothing)
- Applicable to other languages
- Can point out non-emotive elements
- Pattern lists contained all Nitta et al.'s seed words → could improve Nitta with patterns

Conclusions

- Presented research on cyberbullying detection.
- Proposed novel method.
  - Combinatorial algorithm applied in automatic extraction of sentence patterns.
- Used those patterns in classification of cyberbullying.
- Tested on actual data obtained by Internet patrol.
- Outperformed previous methods.
- Requires minimal human effort.

Future work

- Apply different preprocessing and classifiers for further improvement.
- Obtain new data by applying method in practice.
- Verify the actual amount of CB information on the Internet and reevaluate in more realistic conditions.

Thank you for your kind attention!

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