A Novel Approach to Morphological Disambiguation for Turkish

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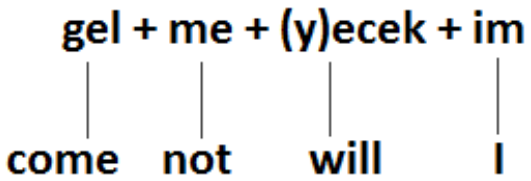
Outline

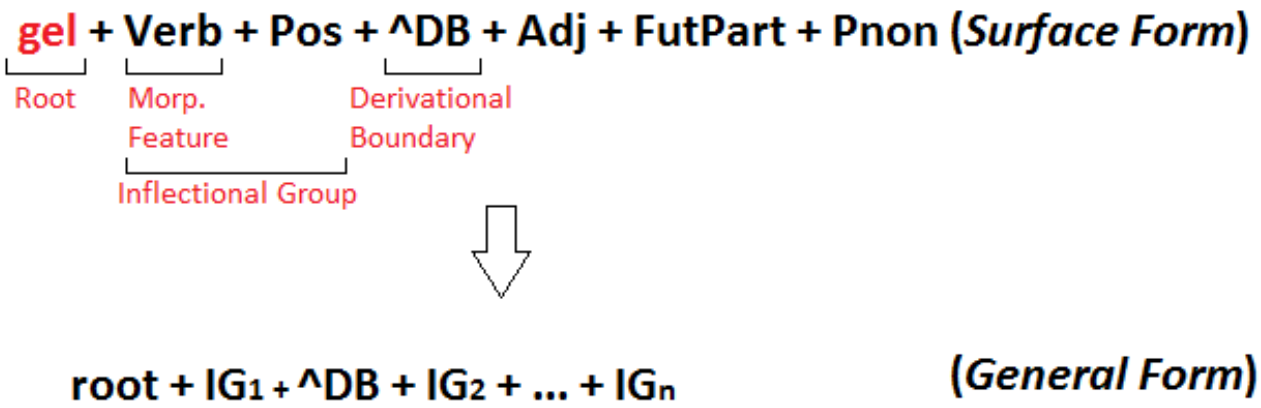
Morphology

- Turkish
  - Agglutinative, inflectionally rich language.
  - Syntactical information is expressed by suffixation (morphology).

Gelmeyeceğim. (I will not come)



Morphological Parse



- Turkish $\rightarrow$ 126 morph. feature, theoretically unlimited number of tags.
- Generated by morphological parsers $\rightarrow$ [Oflazer94, Sak,et al.08].

Turkish Morphology

otur $\rightarrow$ sit
oturt $\rightarrow$ make X sit
oturttur $\rightarrow$ have Y make X sit
oturtturt $\rightarrow$ have Z have Y make X sit
oturtturtur $\rightarrow$ have T have Z have Y make X sit
oturtturturt $\rightarrow$ have W ...

- Theoretically unlimited # of word forms $\rightarrow$ unlimited # of possible tags.
- Data sparseness!

Morphological Disambiguation

- Selection of accurate morphological parse among all possible parses
- Agglutinative languages $\rightarrow$ Turkish
  - $\simeq$ 40% ambiguity rate, $\simeq$ 4 parses for ambiguous tokens
- Parses for word "gelecek":

  gelecek + Noun + A3sg + Pnon + Nom
  gelecek + Adj
  gel + Verb + Pos + Fut + A3sg
  gel + Verb + Pos + ^DB + Adj + FutPart + Pnon

Related Work

- Two main approaches:
  - Rule-based approaches
    $\rightarrow$ Greedy Prepend Algorithm (GPA) [Yüret, et al.06]
  - Statistical approaches
    $\rightarrow$ Baseline Trigram-based Model [Hakkani-Tür,et al.02]

Problem Definition

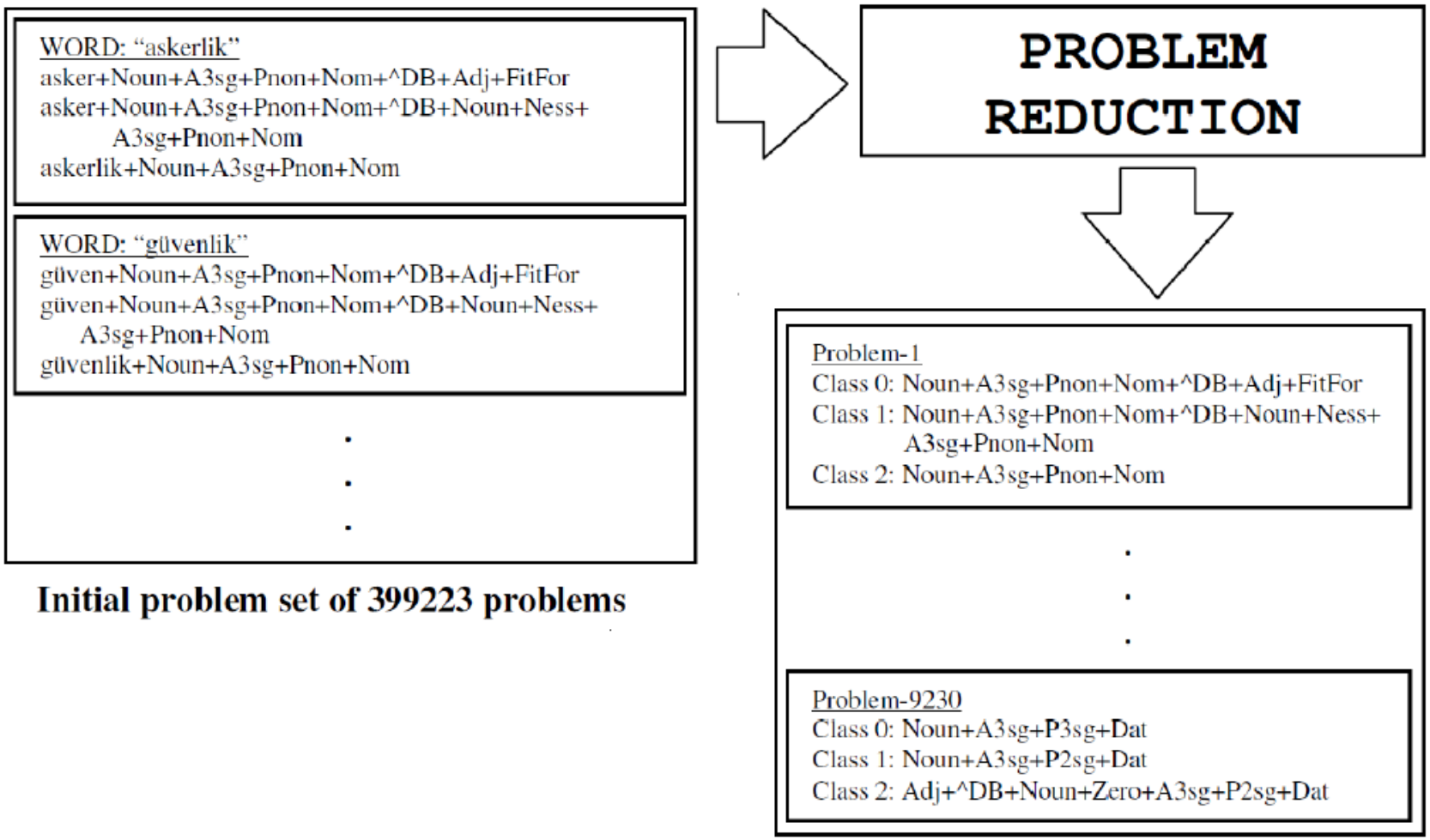
- Find the correct morphological parse from N possible parses excluding the root word.
- Each distinct parse corresponds to one class
- Parses for word "gelecek" :

  gelecek + Noun + A3sg + Pnon + Nom
  gelecek + Adj
  gel + Verb + Pos + Fut + A3sg
  gel + Verb + Pos + ^DB + Adj + FutPart + Pnon

  $\Downarrow$

  Class 1: Noun + A3sg + Pnon + Nom
  Class 2: Adj
  Class 3: Verb + Pos + Fut + A3sg
  Class 4: Verb + Pos + ^DB + Adj + FutPart + Pnon
- Total of 399223 problems for 1M size ambiguous data

Problem Reduction



Initial problem set of 399223 problems

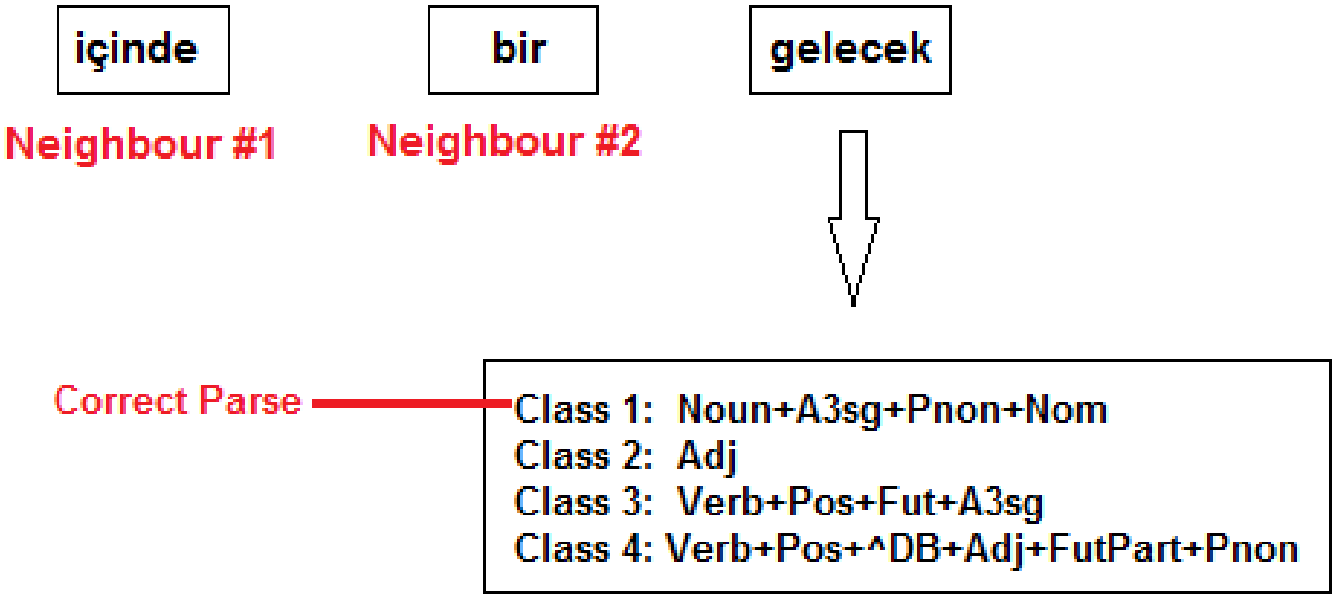
Problem Reduction

- Distribution of problems with respect to the # of instances

Number of Instances	Number of Problems
1 – 10	7213
11 – 100	1617
101 – 1000	427
1001 – 10000	60
10001 – 100000	3

Training Data

- 3-word window → ambiguous word and 2 preceeding neighbours.
- Training instance → existence of morp. features in all parses of neighbour words.
- 126x2 feature + class info.



Experimental Setup-Data

- Training set $\rightarrow$ 1M tagged disambiguated tokens (including end of sentence, title and document markers). 50673 sentences.
- Test set $\rightarrow$ 958 tokens, and 42 sentences. 379 tokens are morphologically ambiguous.
- Test set problem definitions are subset of training phase problem set!!

Experimental Results

Method	**Acc.(%)**	**Method**	**Acc.(%)**
NaiveBayes	93.83	Logistic Regression	94.67
Conjunctive Rule	66.25	SVM	94.98
k-NN(k=10)	95.40	J48 Tree	**95.61**
LWL	94.67	Baseline Trigram-Based Model	**95.48**
J48 Tree(no prunning)	95.09	Greedy Prepend Algorithm	**95.82**
KStar	94.36	Perceptron(23 Features)	**96.28**
NNge	90.49		

Conclusions

- Define MD problem as multiple classification problems.
- J48 is the best performer among 10 classifiers $\rightarrow$ slightly better than "Baseline Trigram-Based Model".
- Performance improvement $\rightarrow$ expanding the feature set or linear/non-linear feature extraction mechanism