Topic-Oriented Information Detection and Scoring

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Road Map

- Introduction
- Hybrid approach for TOIDS
- Experimental Results
- Conclusions

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- Traditional Solutions
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  - Statistical and Machine Learning Methods

- Drawbacks
  - Influenced by the coverage of the lexicon
  - Paleness in domain adaption

Motivation

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  - Self learning

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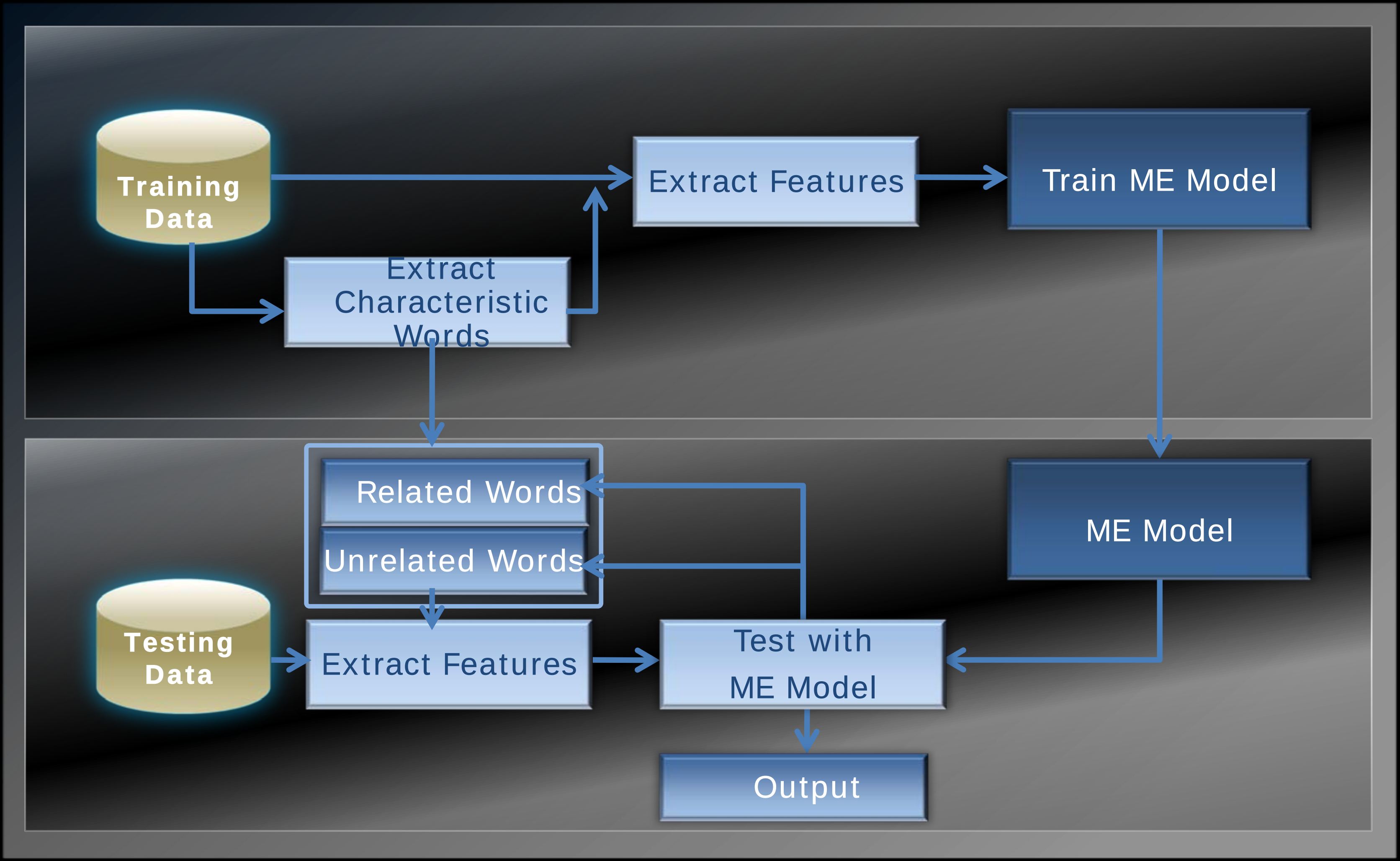
Flow chart of TOIDS system



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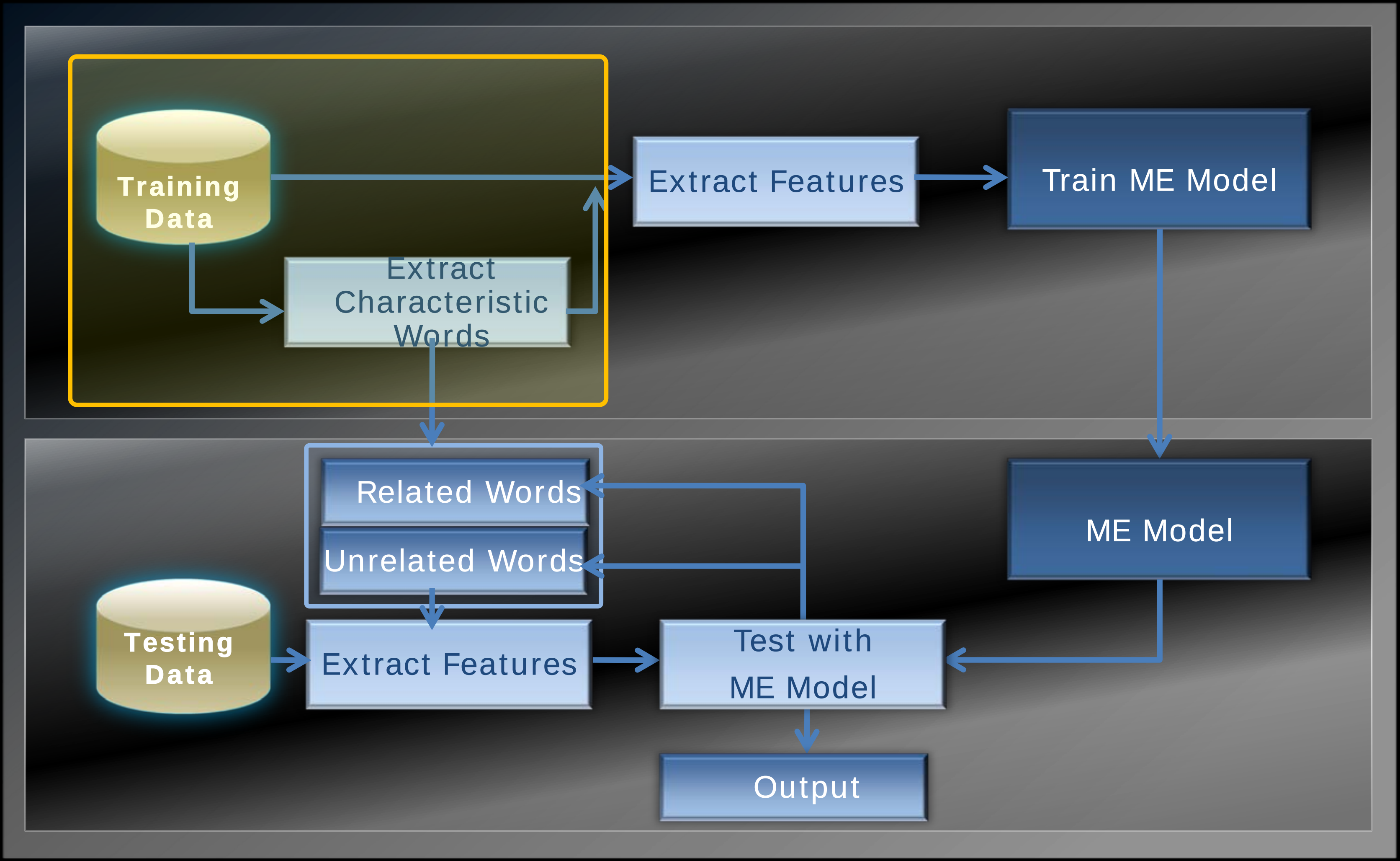

Z-Score Algorithm

	Topic related	Rest	
ω	a	b	a + b
not ω	c	d	c + d
	a + c	b+ d	n=a+b+c+d

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- where

$$\Pr(\omega) = (a + b)/n$$

$$n! = a + c$$

Z-Score Example

	Topic related	Rest	
“Bomb”	561	241	802
-“Bomb”	69,324	55,100	124,424
n!= a + c	69,885	55,341	125,226

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$$Zscore(\omega) = \frac{a - n!Pr(\omega)}{\sqrt{n!Pr(\omega) \cdot (1 - Pr(\omega))}}$$

$$= \frac{561 - 69885 * 802/125226}{\sqrt{69885 * 802/125226 * (1 - 802/125226)}}$$

$$= 5.3787$$

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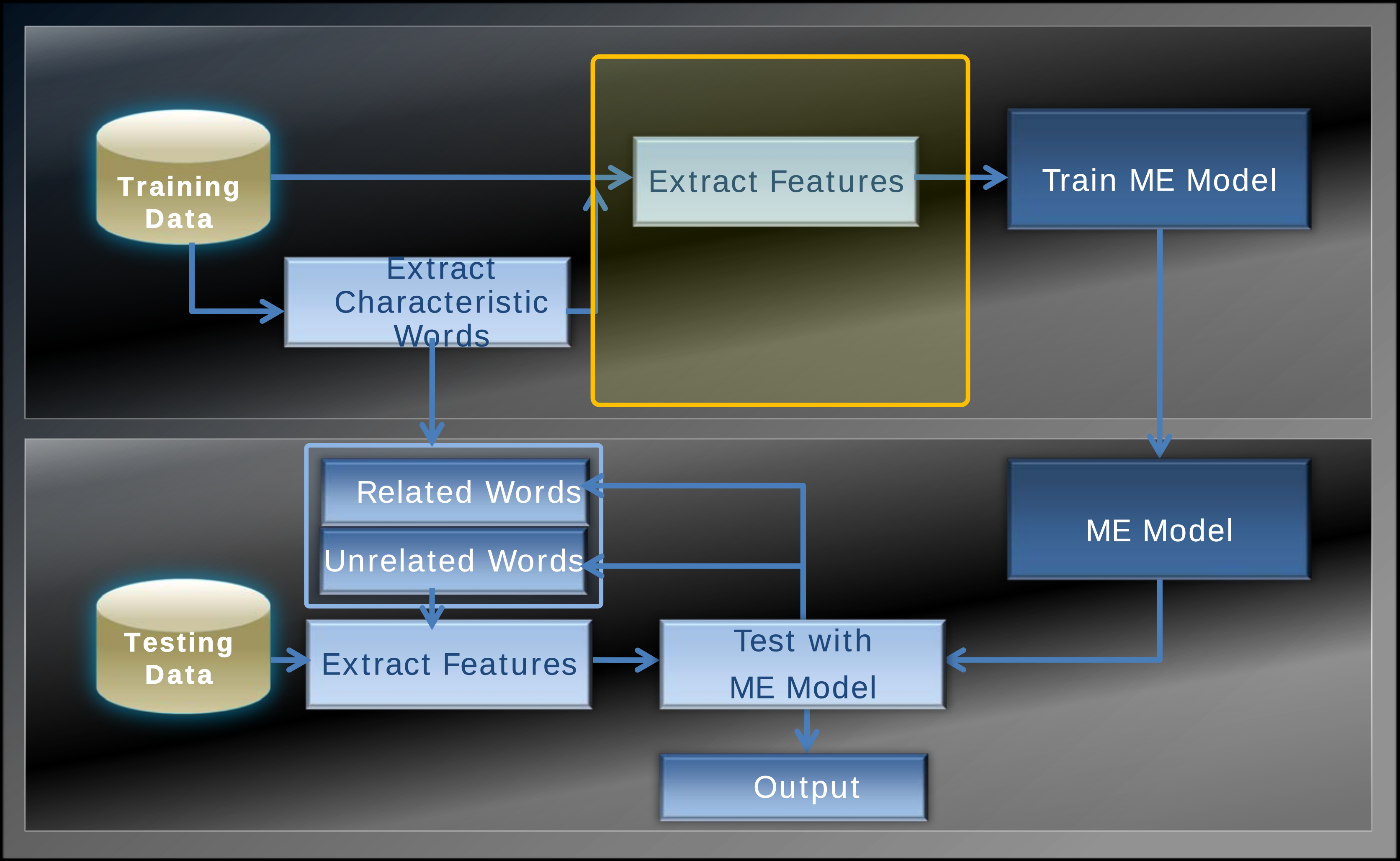

Training Data

Extract Features

Train ME Model

Extract Characteristic Words

Related Words

Unrelated Words

ME Model

Testing Data

Extract Features

Test with ME Model

Output

Features

Features	Type	Description
n-gram word	Related Unrelated	n-gram for related words n-gram for unrelated words
n-gram POS	Related Unrelated	n-gram for related POS tags n-gram for unrelated POS tags
word number	Related Unrelated	related word number in current sentence unrelated word number in current sentence
major POS	Related Unrelated	POS tag correspond to highest Z-Score value POS tag correspond to lowest Z-Score value

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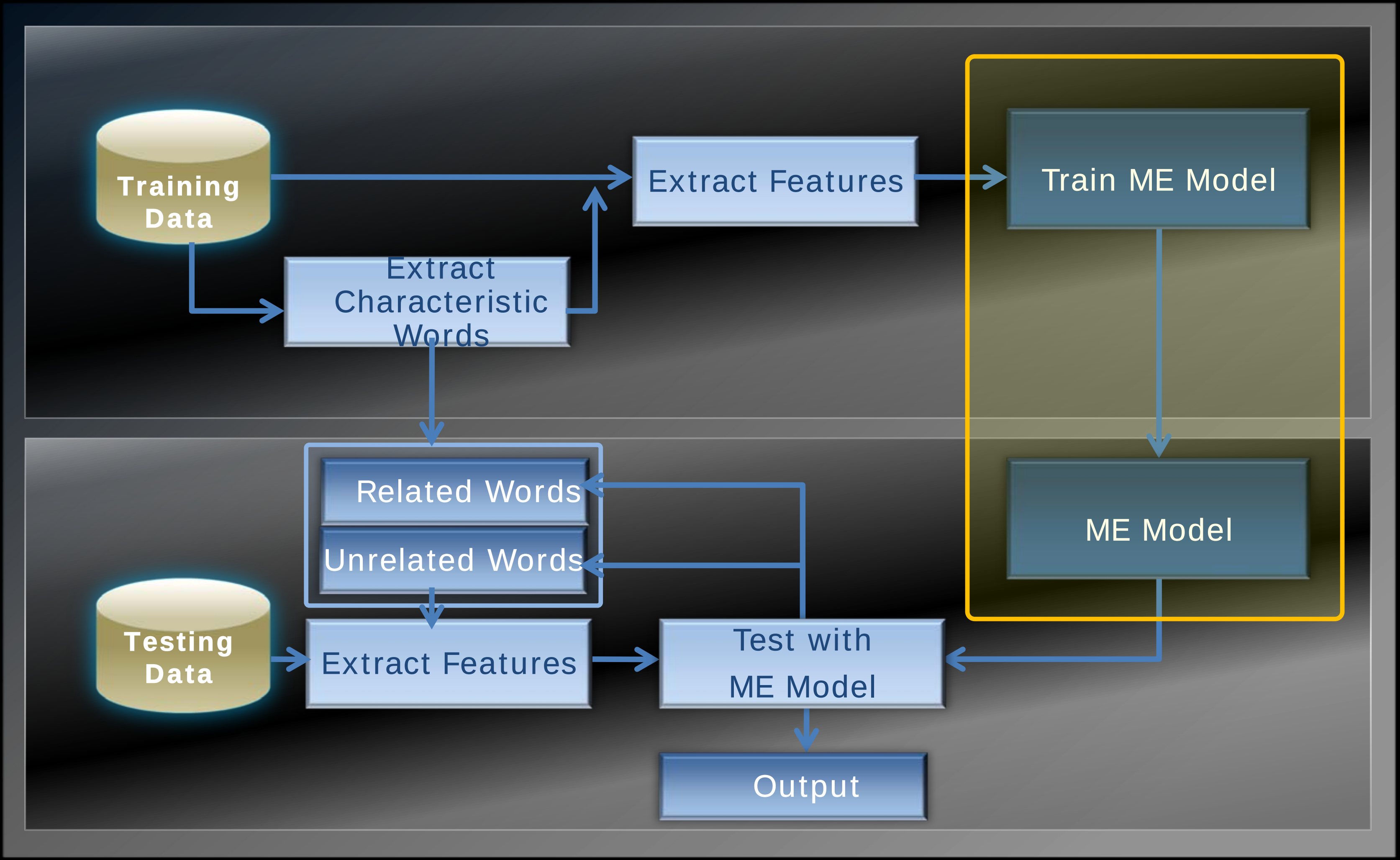

Statistical Model

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- Maximum Entropy Model(MEM)

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- Maximum Entropy Model(MEM)
  - Scoring based on Rel_score
  - 5 degree levels

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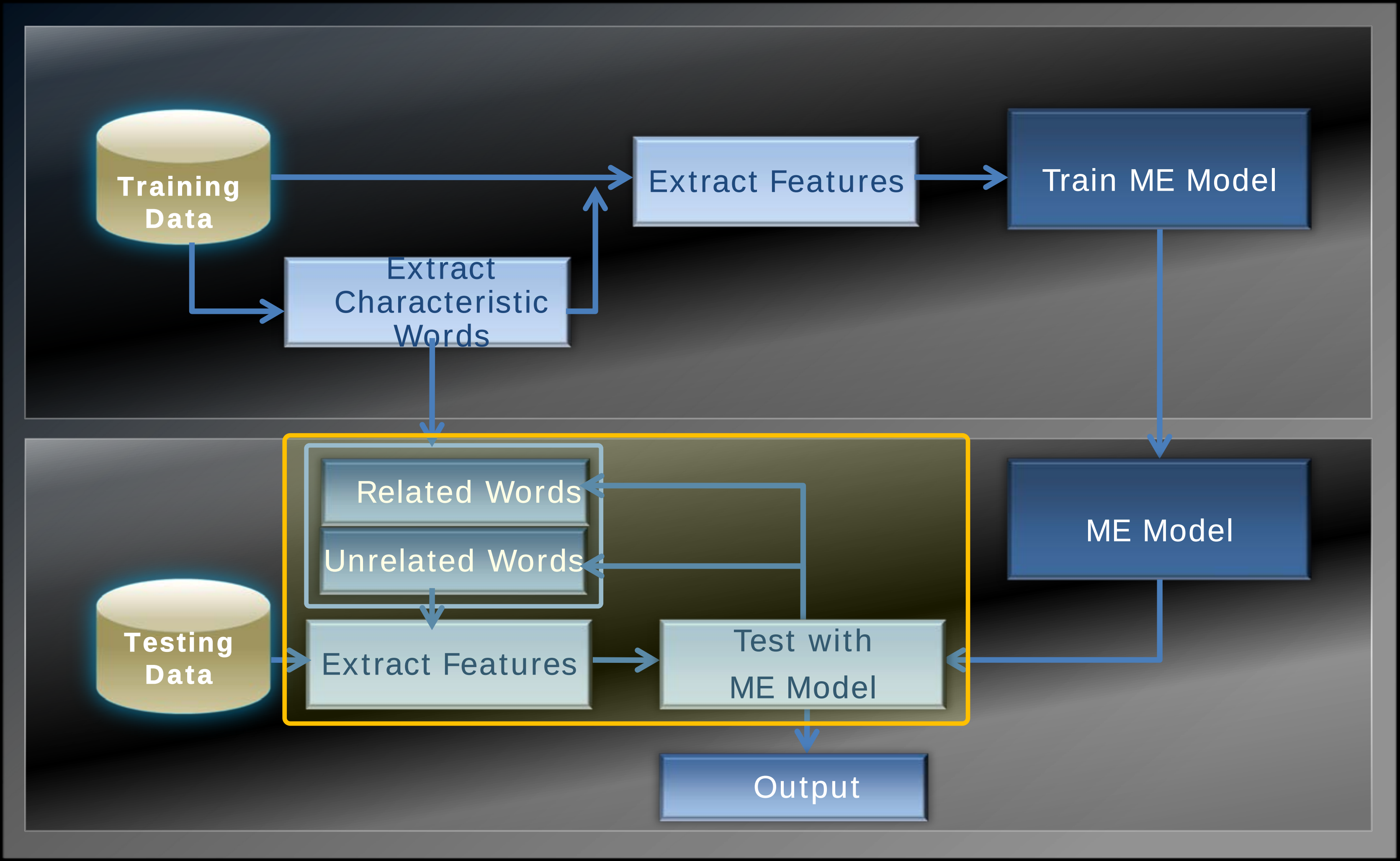

Self Learning

- Augment characteristic word lexicon based on prediction results

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  - About 5000 webpage documents from 10 websites
  - Documents are crawled from websites directly rather than retrieval with specified key words
  - Manually labeled
  - About 20 percent of topic related documents

System comparison under different configurations

Round	Precision	Recall	F-Score
ME + SingleRelWordMatch	62.38	84.36	75.49
ME + RelatedWordCom	79.84	82.75	81.76
ME + CharacteristicWordCom	82.30	82.81	82.64
ME + CharacteristicWordCom + Self-Learning	83.49	83.02	83.18

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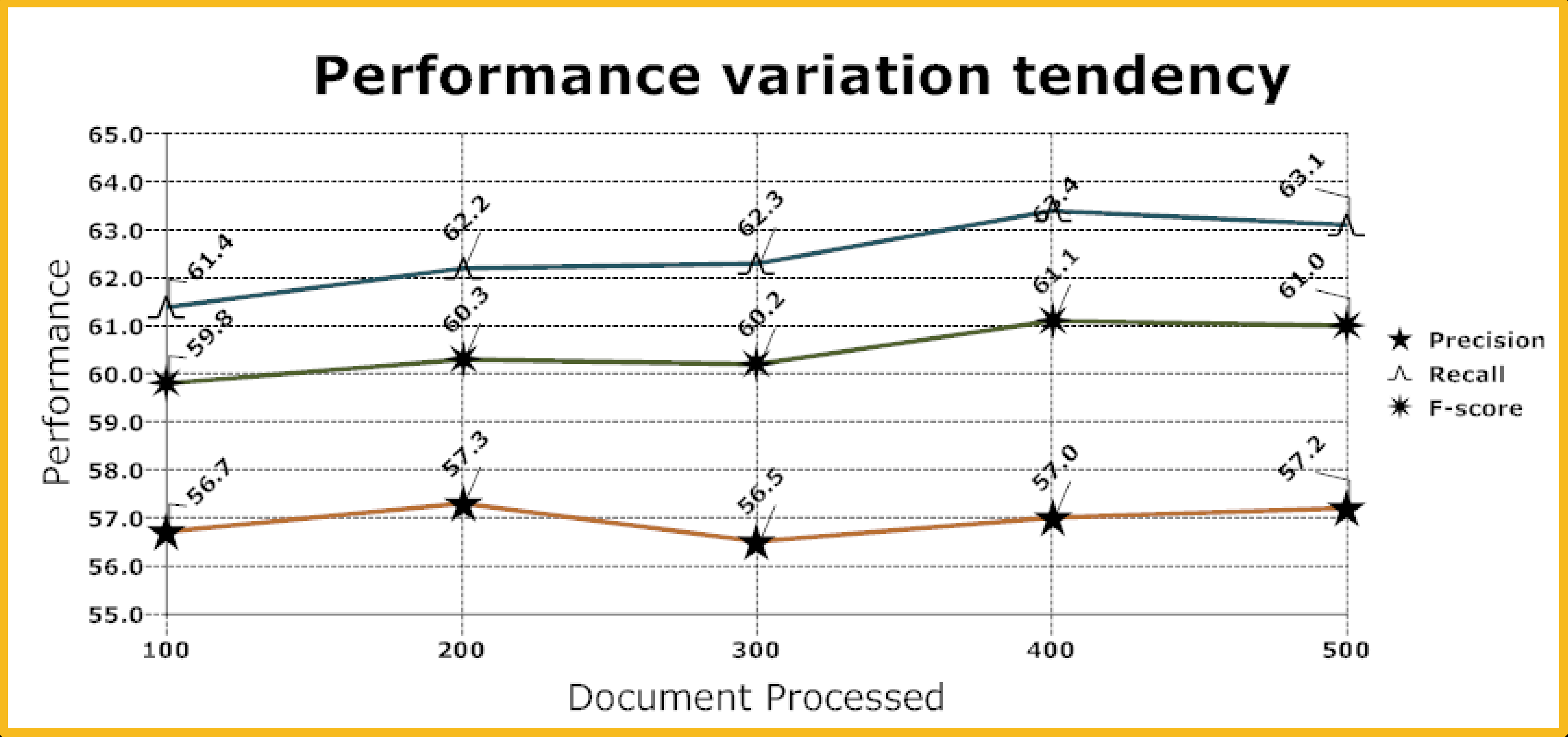
- Domain Adaptation
  - Training: one sub-collection related to transportation (500 documents)
  - Testing: one concerning criminal incidents (400 documents)
  - Measurement: whenever one hundred new documents were classified, F-score is recalculated over all testing documents processed till the current time

Performance variation tenden



Scoring results from TOIDS

Title	Rel_score
一颗子弹 马英九连战矛盾面临 … One Bullet The contradiction between Ma Ying-jeou and Lien Chan faces …	5
男子为讨68.6万贷款持刀 … For debt collection of 686,000, men armed with knives …	4
河南交通厅长董永安落马… Transport Minister in Henan province Dong Yongan collapses …	5
被囚俄罗斯寡头能把2亿… Jailed Russian oligarch uses 200,000,000 …	3

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Future work

1. Use quantified Z-score of characteristic words to judge a sentence's relevance
2. Distinguish the importance of sentences occurring at different positions
3. Implement mutual enhancement mechanism between sentence and document
4. Enable mistakenly extracted characteristic words eliminated automatically

Thank you!

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Questions?