

OHSU/Portland VAMC Team Participation in the 2010 i2b2/VA Challenge Tasks

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Richard Sproat², Brian Roark², Kristy Hollingshead², Kari Baker²**

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OHSU/Portland VAMC submissions

- Our team participated in all three challenge tasks

	<i>Assertions</i>	<i>Relations</i>	<i>Concepts</i>
Aaron M. <u>Cohen</u>	X	X	
Kyle H. <u>Ambert</u>	X	X	
<u>Jianji</u> Yang	X	X	X
Robert <u>Felder</u>	X	X	X
Richard <u>Sproat</u>	X	X	X
Brain <u>Roark</u>	X	X	X
<u>Kristy</u> Hollingshead	X	X	X
<u>Kari</u> Baker	X	X	X

Assertions

Relations

Concepts

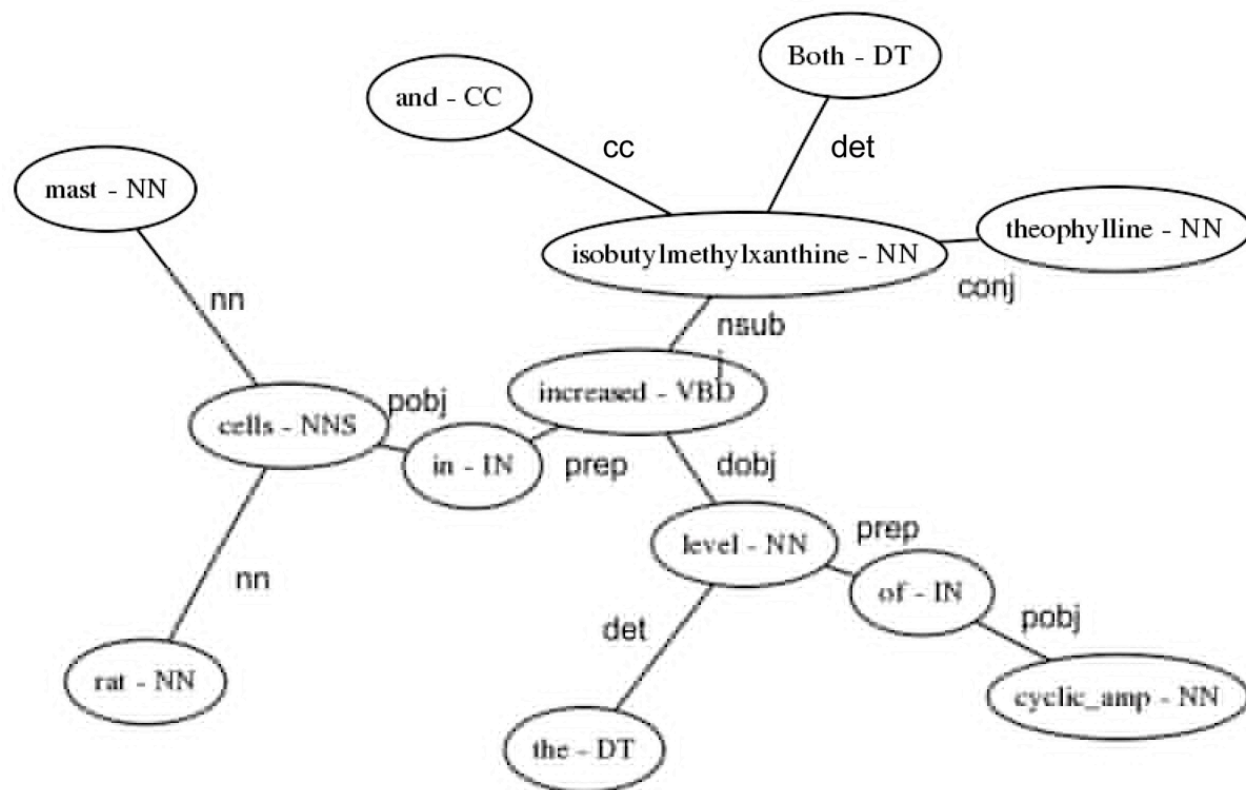
Create a system for labeling concepts expressed in the text of clinical records into one of four categories.

Assertions

Relations

Concepts

Create a system for labeling concepts expressed in the text of clinical records into one of four categories.



- The concept tasks participants were unable to join us here. Briefly,
 - We parsed each line with the Charniak parser — retuned to perform well on medical tasks, using 30 samples of training data.
 - Processing errors occurred, and likely decreased overall task performance.

Assertion Task

Assertions

Relations

Concepts

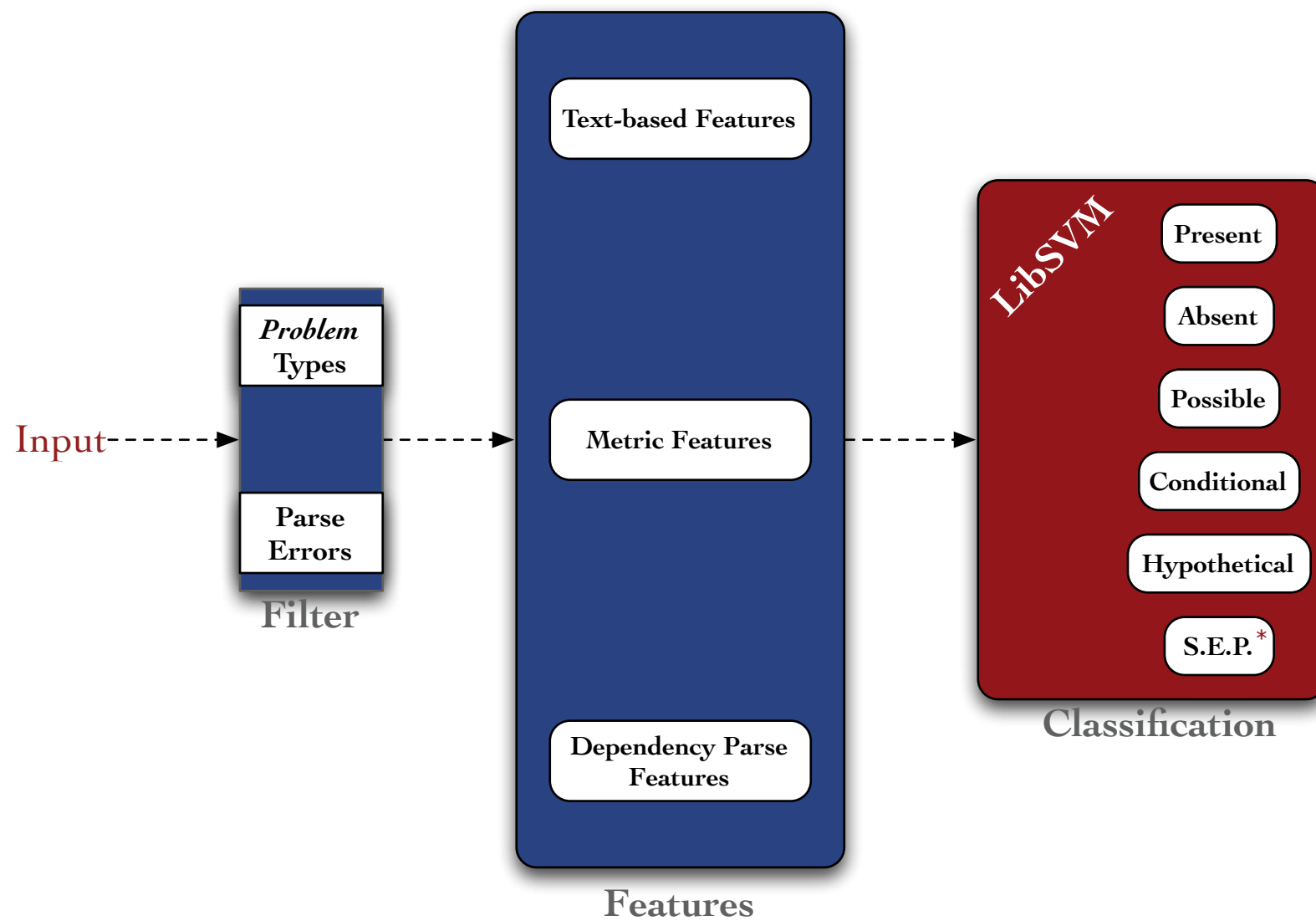
Create a system that will correctly interpret assertion statements as being present, absent, uncertain, conditional, or not associated with the patient.

Assertion Task: *general approach*

Assertions

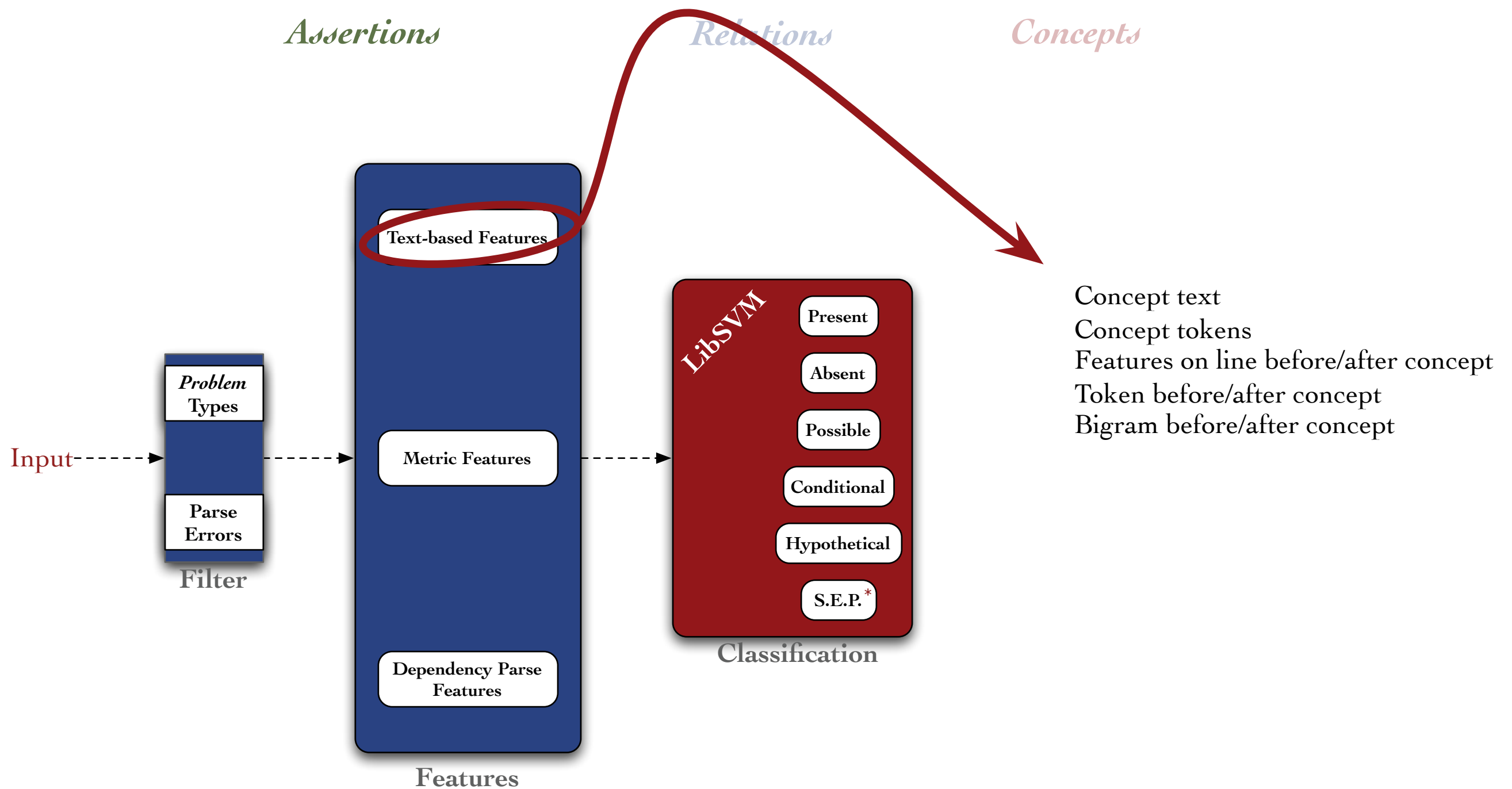
Relations

Concepts



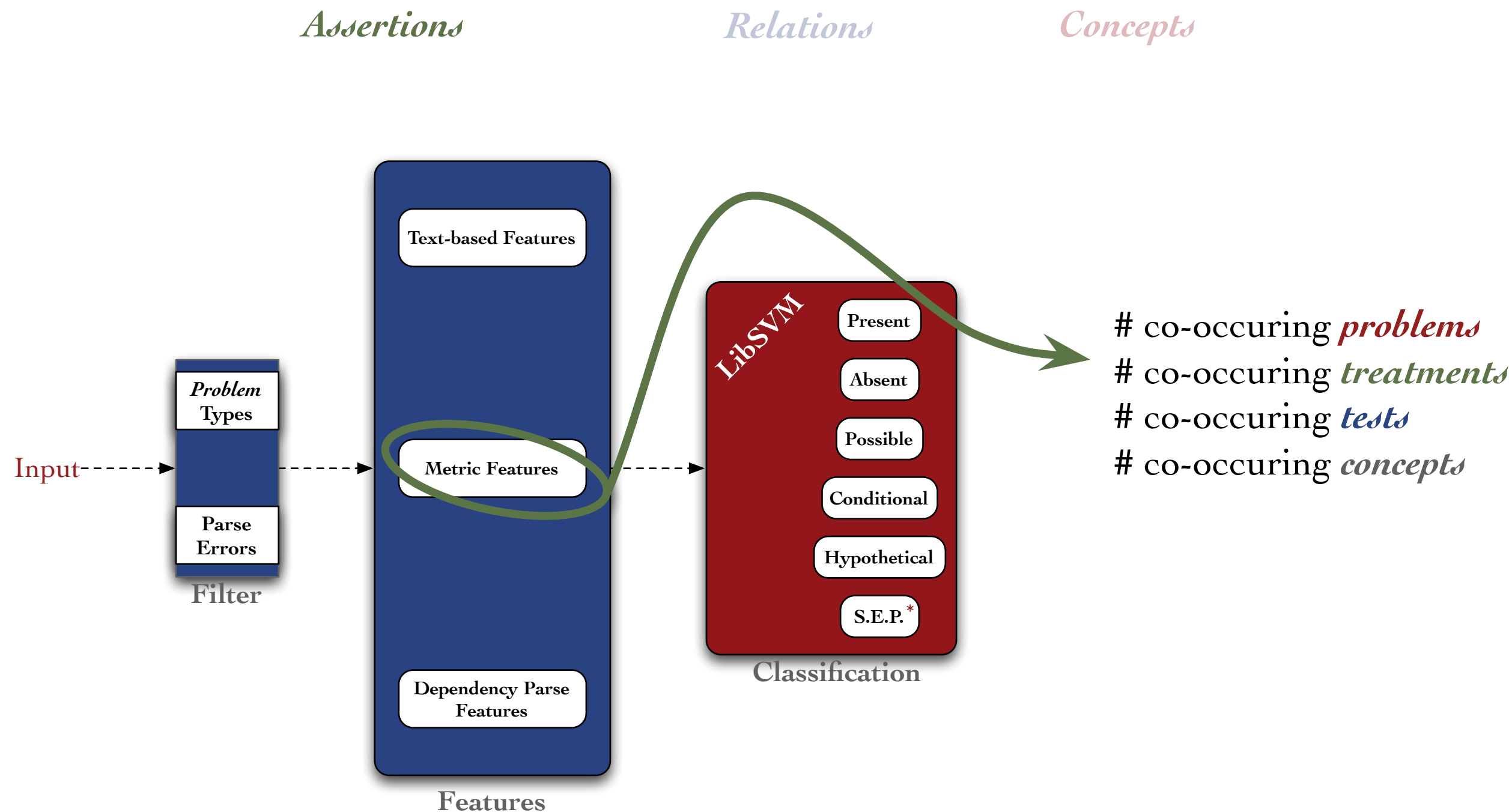
* *Adams, 1982*

Assertion Task: *general approach*



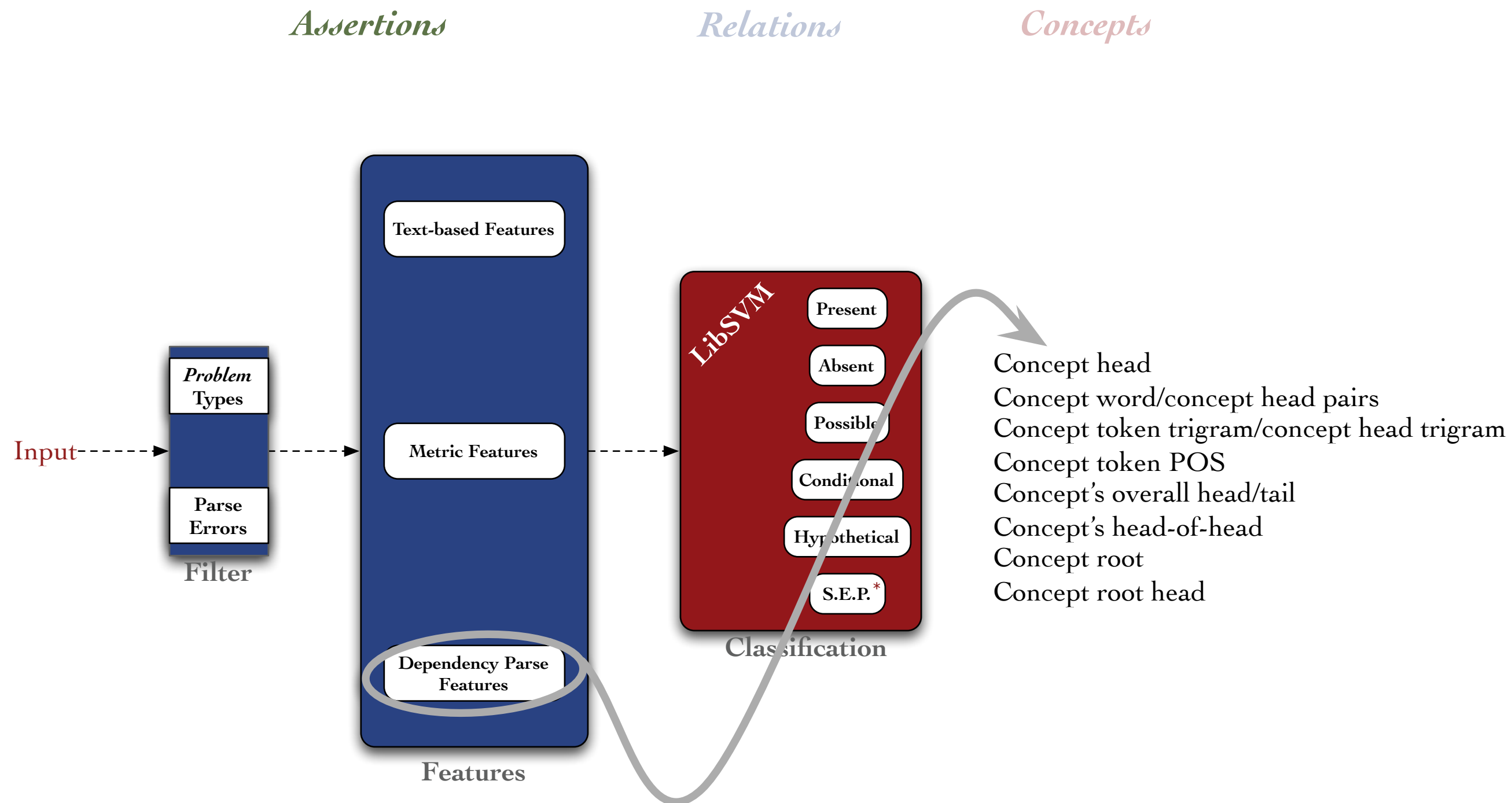
* *Adams, 1982*

Assertion Task: *general approach*



* Adams, 1982

Assertion Task: *general approach*



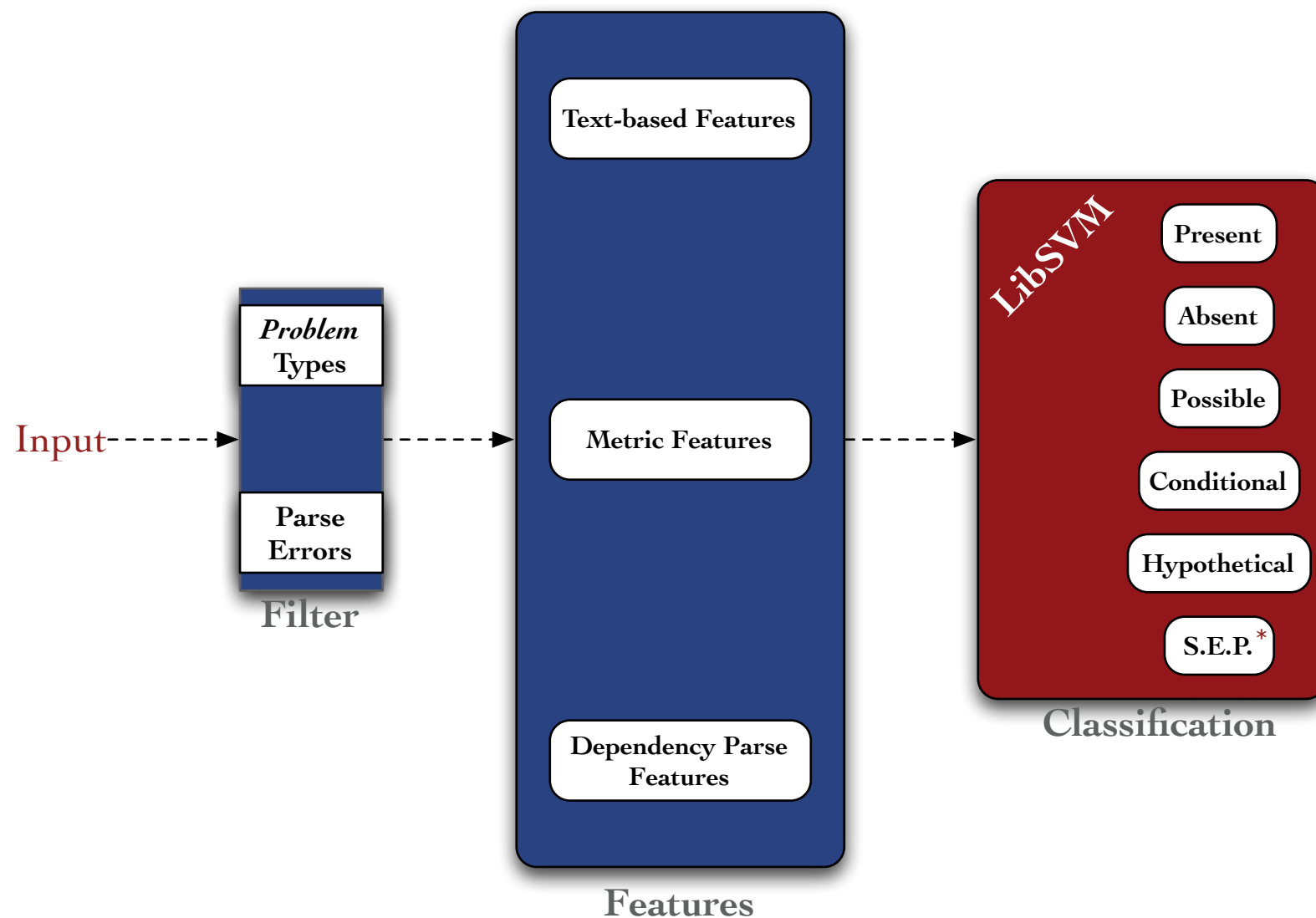
* *Adams, 1982*

Assertion Task: *general approach*

Assertions

Relations

Concepts



- For classification, we used LibSVM's 1-against-1 classifier with a linear kernel
 - other classifiers were tried as well, although none led to greatly-improved performance: other kernels, ECOC, DAG, etc.

* *Adams, 1982*

Assertion Task: *cross-validation results*

Submission 1

Text

Submission 2

Text

Metric

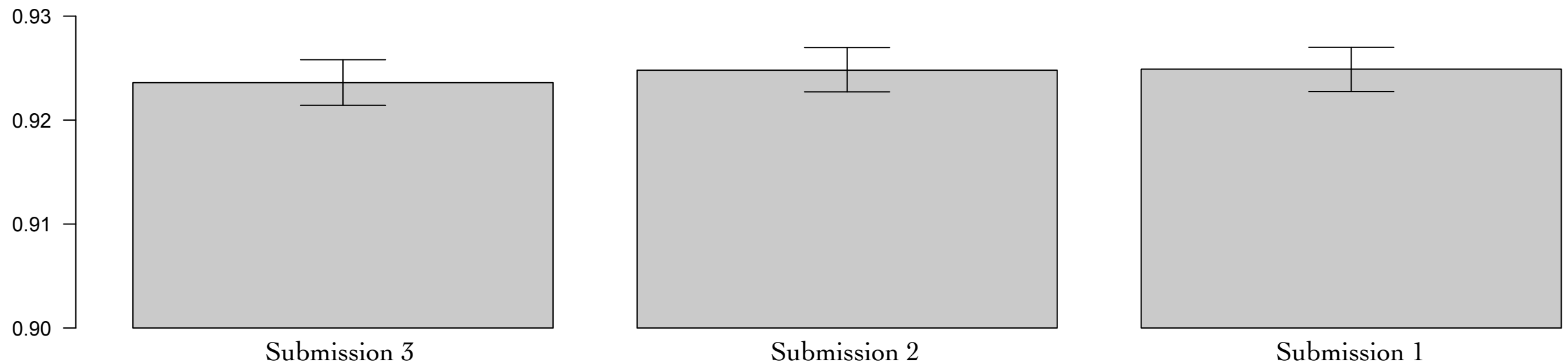
Submission 3

Text

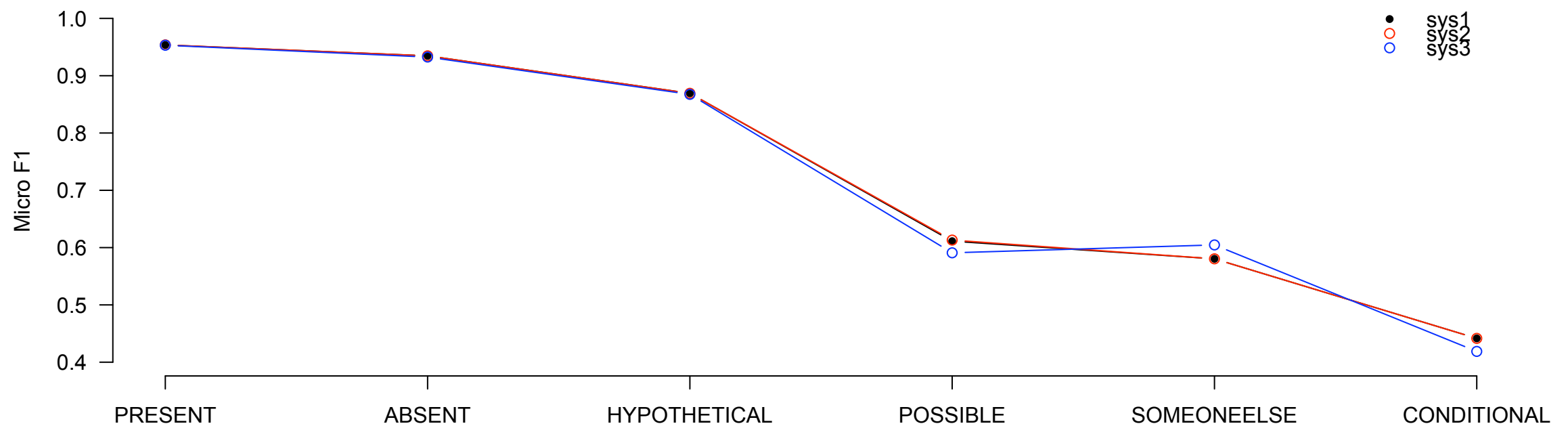
Metric

Dependency

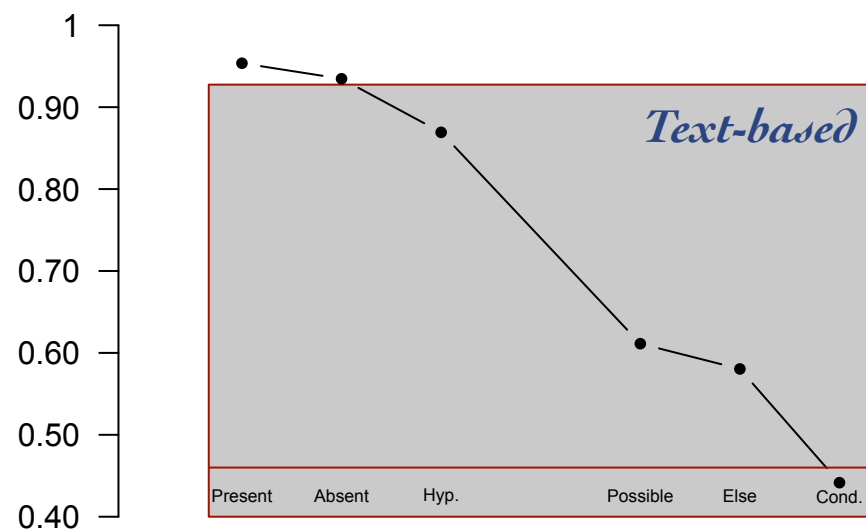
Cross-validation Results



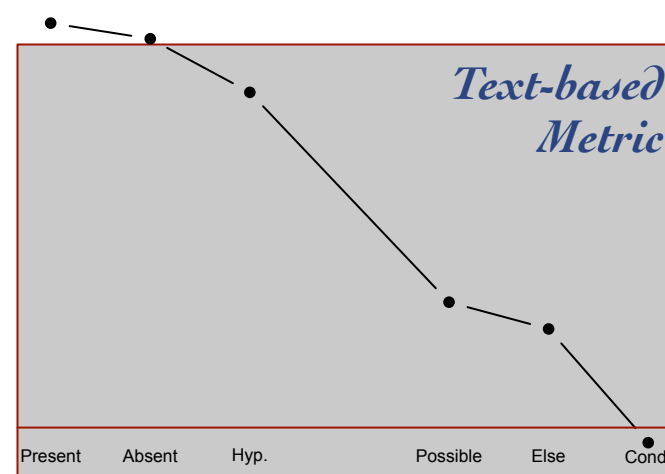
Assertion Task: *final results*



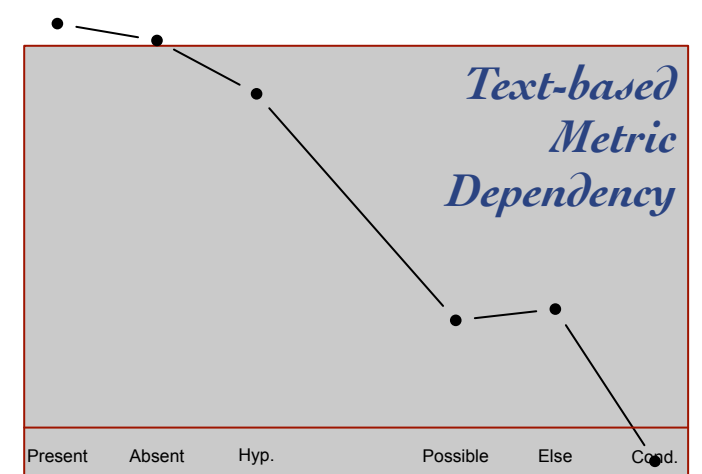
Final Results



System 1



System 2



System 3

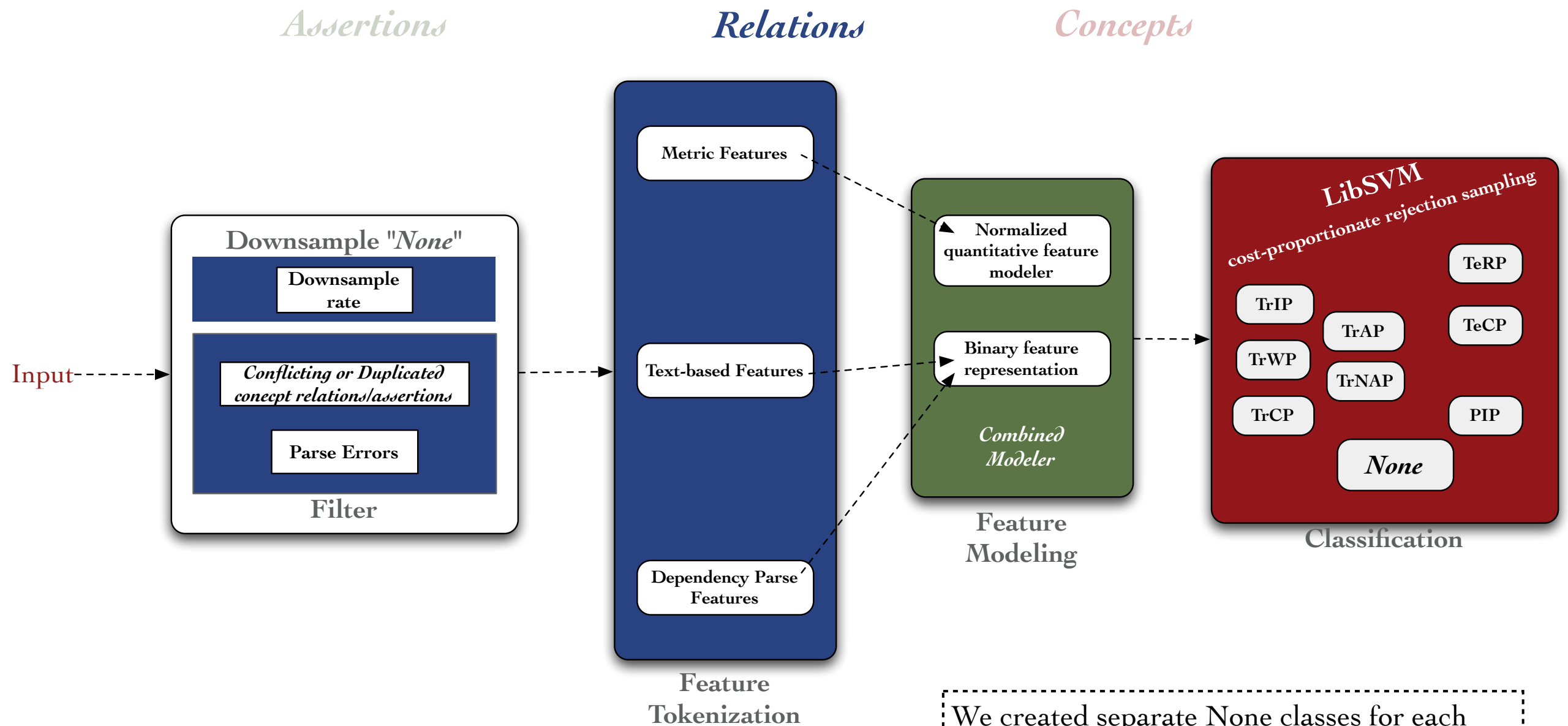
Assertions

Relations

Concepts

Create a system that will identify concept relations between medical problems, tests, and treatments. Label them into one of nine categories.

Relation Task: *general approach*



We created separate None classes for each main category — **Treatment**, **Problem**, **Tests**.

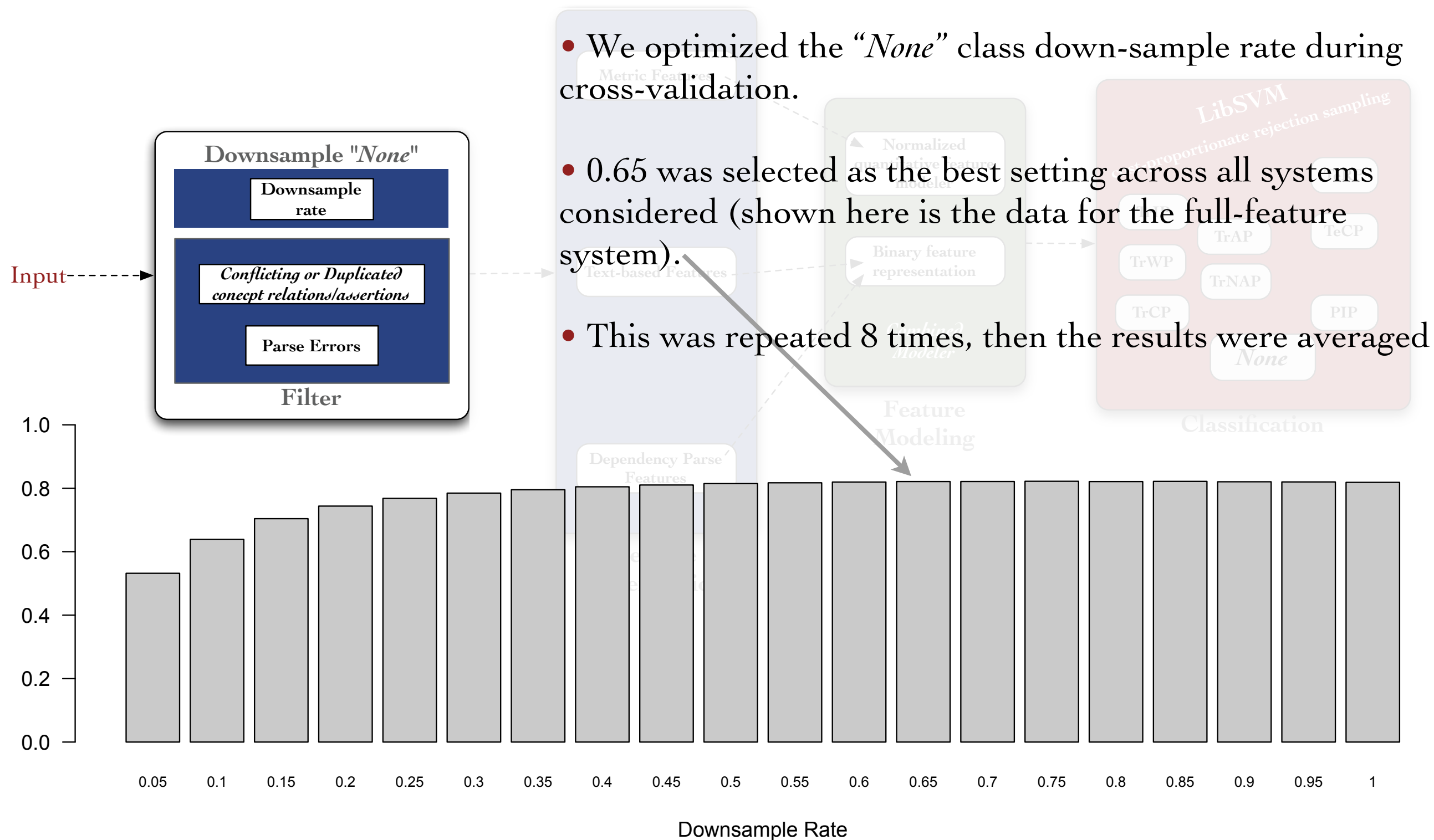
We found this improved cross-validation performance somewhat.

Relation Task: *down-sample cross-validation results*

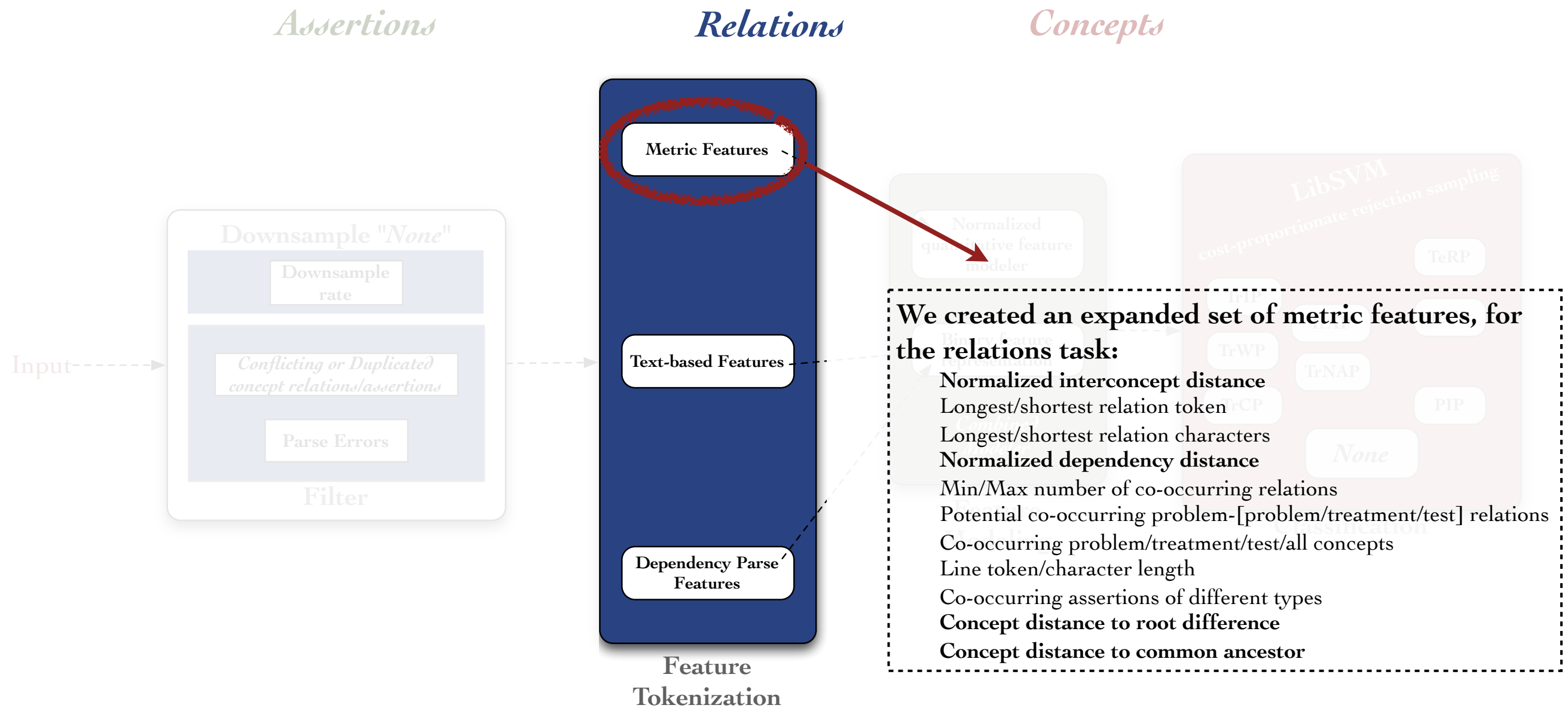
Assertions

Relations

Concepts



Relation Task: *features*



Relation Task: *features*

Assertions

We picked similar text features for the relations task, as in the assertions task.

concept text
concept tokens
line before/after
concept types
concept assertions
overlapping concepts

Downsample "None"

Downsample
rate

Conflicting or Duplicated
concept relations/assertions

Parse Errors

Filter

Relations

Metric Features

Text-based Features

Dependency Parse
Features

Feature
Tokenization

Concepts

We created an expanded set of metric features, for the relations task:

Normalized interconcept distance
Longest/shortest relation token
Longest/shortest relation characters
Normalized dependency distance
Min/Max number of co-occurring relations
Potential co-occurring problem-[problem/treatment/test] relations
Co-occurring problem/treatment/test/all concepts
Line token/character length
Co-occurring assertions of different types
Concept distance to root difference
Concept distance to common ancestor

Normalized
quantitative feature
modeler

LibSVM

cost-proportionate rejection sampling

TeRP

TfP

TfWP

TfNAP

TfCP

PIP

None

Relation Task: *features*

Assertions

We picked similar text features for the relations task, as in the assertions task.

concept text
concept tokens
line before/after
concept types
concept assertions
overlapping concepts

Relations

Metric Features

Text-based Features

Dependency Parse Features

Feature
Tokenization

Concepts

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Potential co-occurring problem-[problem/treatment/test] relations
Co-occurring problem/treatment/test/all concepts
Line token/character length
Co-occurring assertions of different types
Concept distance to root difference
Concept distance to common ancestor

We only represented dependency features for concepts occurring on the same line.

Concept head, head/word pairs
Stemmed concept head/word pairs
Concept token/head trigram
Concept relation dependency
Concept token/head POS
Concept with overall concept head
Concept head token & POS
Concept overall tail
Concept and overall tail
Concept sentence root token
Concept sentence root POS
Concepts' min/max distance to root

Relation Task: *classification*

Assertions

We picked similar text features for the relations task, as in the assertions task.

concept text
concept tokens
line before/after
concept types

concept assertions

overlapping concepts

Downsample "None"

Downsample
rate

Conflicting or Duplicated
concept relations/assertions

Pass Features

We only represented dependency features for concepts occurring on the same line.

Concept head, head/word pairs
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Concept token/head POS
Concept with overall concept head
Concept head token ϵ ' POS
Concept overall tail
Concept and overall tail
Concept sentence root token
Concept sentence root POS
Concepts' min/max distance to root

Relations

Metric Features

Text-based Features

Dependency Parse
Features

Feature
Tokenization

Concepts

Normalized
quantitative feature
modeler

Binary feature
representation

Combined
Modeler

Feature
Modeling

LibSVM
cost-proportionate rejection sampling

TrIP

TrWP

TrCP

TrAP

TrNAP

PIP

TeCP

TeRP

None

Classification

Relation Task: *cross-validation results*

Assertions

Relations

Concepts

Submission 1

Text

Submission 2

Text

Dependency

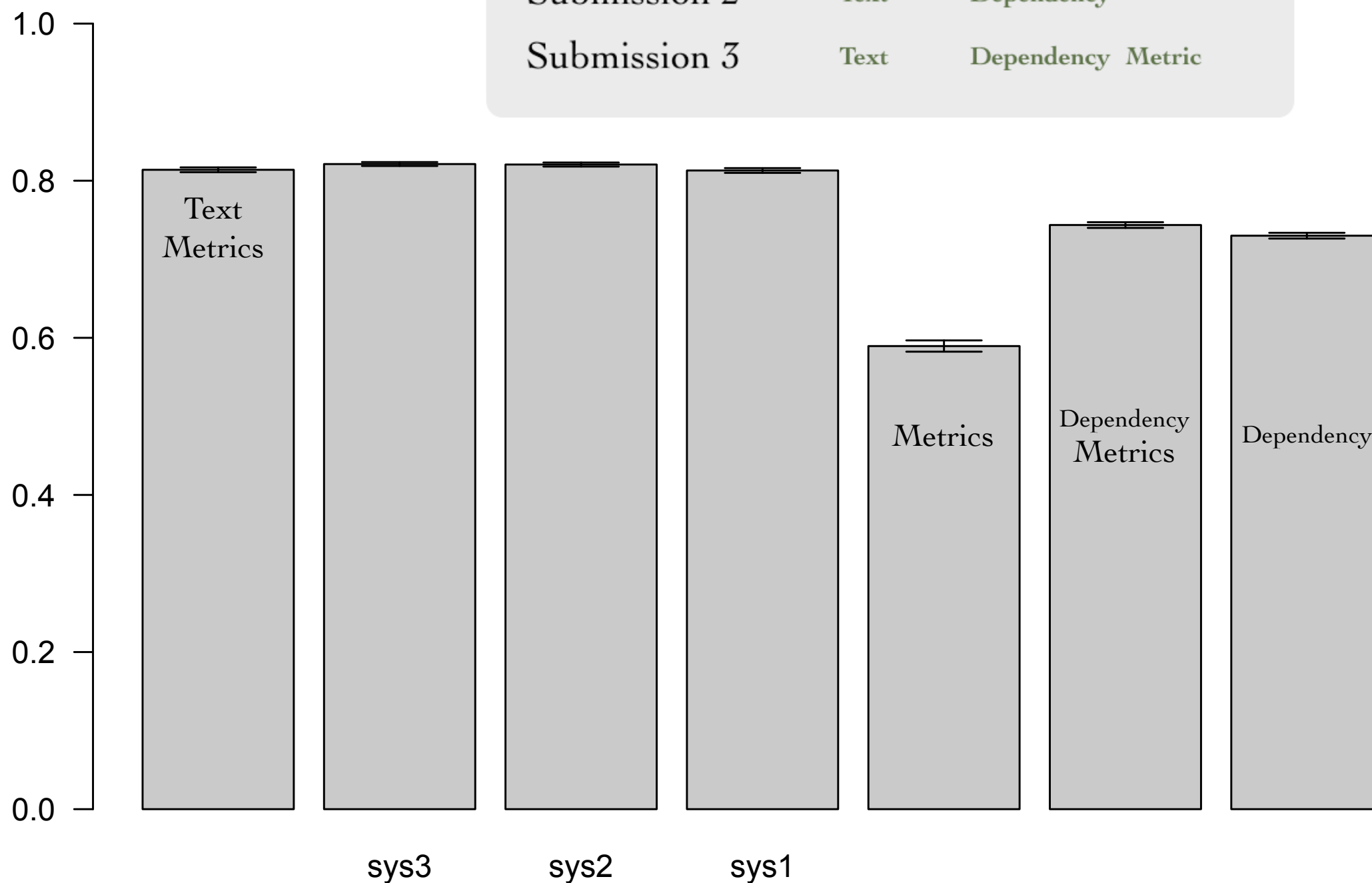
Submission 3

Text

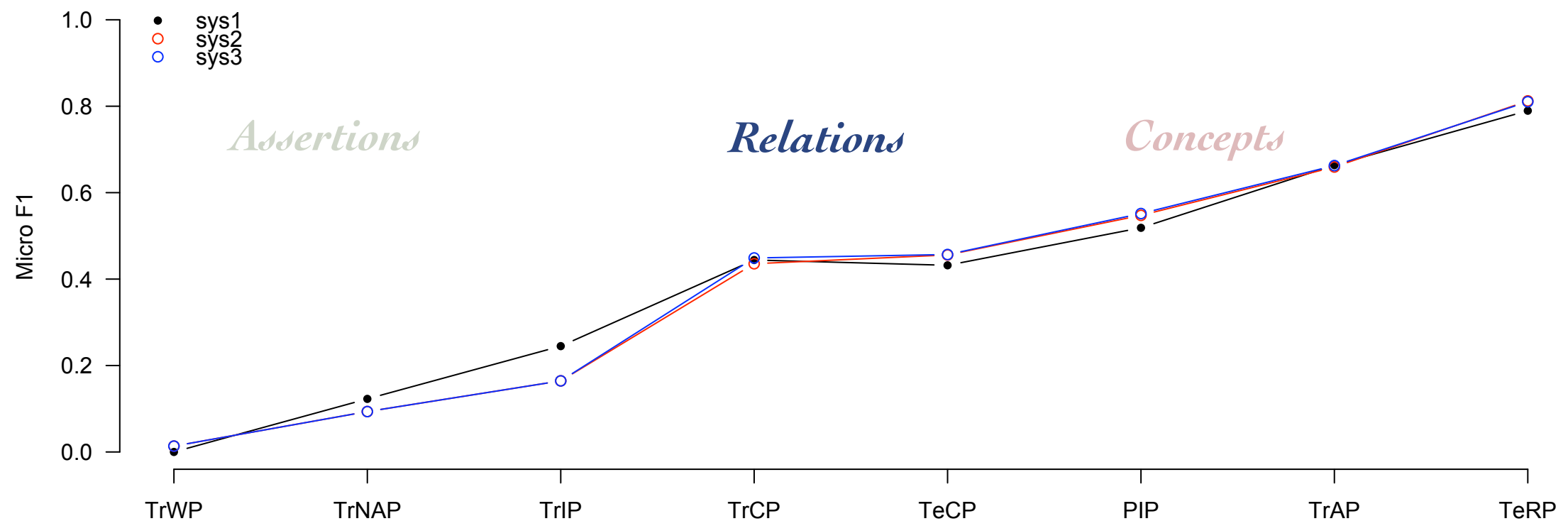
Dependency Metric

- “*sys*” denotes a submitted system.

- Other bars denote other systems considered for submission (using feature representations described therein)

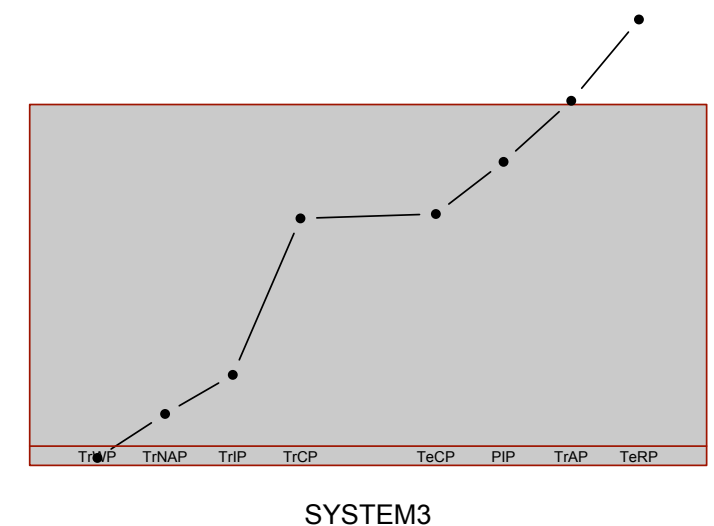
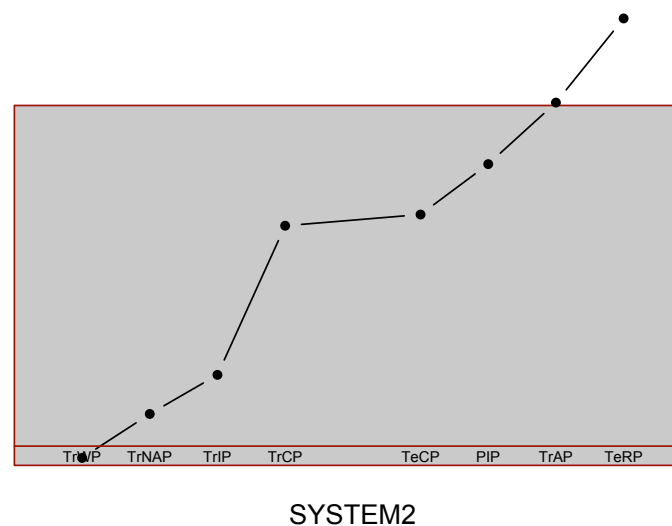
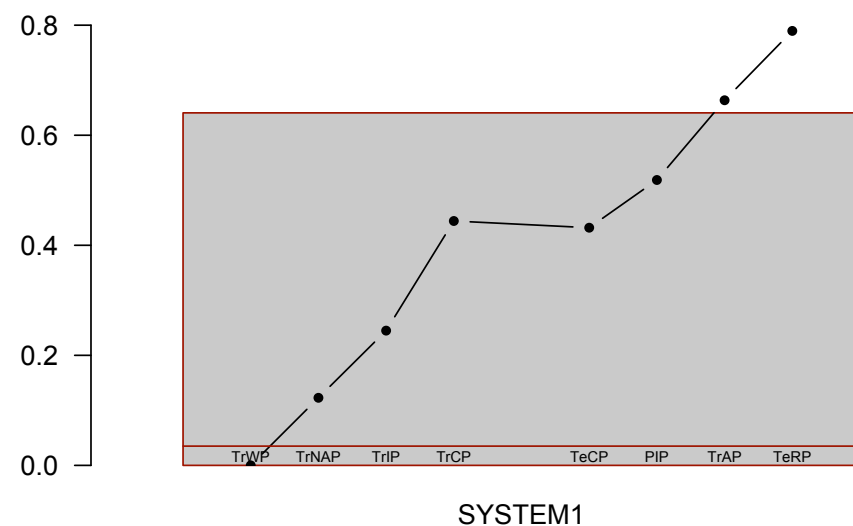


Relation Task: *final results*



There were minor differences on sub-task performance, but, overall, systems did not significantly differ.

Relation Performance



Summary & questions

- The OHSU/Portland VAMC team submitted three systems to each task in the *i2b2* 2010 challenge task.
- Our assertions and relations submissions took a machine learning approach to the tasks, utilizing a combination of textual-, dependency parse-, and metric-based features.
- Thanks, Python.

