Mining and Modeling Relations between Formal and Informal Chinese Phrases from Web Corpora

Zhifei Li and David Yarowsky
Johns Hopkins University

Person-A: 对不起， 我要先下线了，拜拜

Translation: *Sorry, i got to go, bye bye*

Person-A: 对不起， 我要先下线了，拜拜

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Person-B:

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Translation: *Sorry, i got to go, bye bye*

Person-B: bye bye

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Person-B: bye bye

Person-C:

Person-A: 对不起， 我要先下线了，拜拜

Translation: *Sorry, i got to go, bye bye*

Person-B: bye bye

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Language from Mars?

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88 = bye-bye = 拜拜

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BaBa *BaiBai*

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- **Our task: mining *formal-informal* relations from web**

Person-A: 对不起， 我要先下线了，拜拜

Translation: *Sorry, i got to go, bye bye*

Person-B: bye bye

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Language from Mars?

88 = bye-bye = 拜拜

BaBa *BaiBai*

- **Our task: mining *formal-informal* relations from web**
  - Identify *informal* phrases
  - Find their *formal* equivalents

Why is this task important?

- **Enormous amount of informal text on the web**
  - Online-chat, Bulletin Board System (BBS), Web Blog, and so on
- **New informal phrases are created everyday**
- **A general text-processing system does not work well on informal text**
  - machine translation
  - information retrieval
- **Our method can be used for text normalization**

Outline

- **Rule-driven intuition**
- **Data-driven intuition**
- **Our approach**
  - a log-linear model combining both rule- and data-driven intuitions
- **Experimental results**

Data Collection

- **We manually collect about 900 examples**
  - used for both training and testing using cross-validation
- **We then classify the examples into different classes based on our knowledge in Chinese and linguistics**

Homophones

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- **Similar pronunciation but different meaning or written-form**

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Formal	Informal	Percentage
版主 (BanZhu) [system administrator]	斑竹 (BanZhu) [bamboo]	4%
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拜拜 (BaiBai)[bye-bye]	88 (BaBa)	21%

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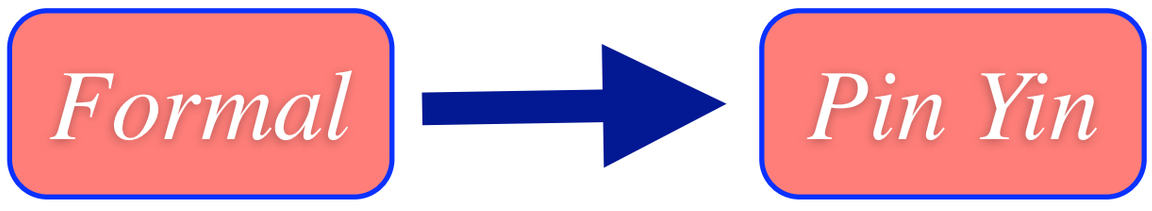

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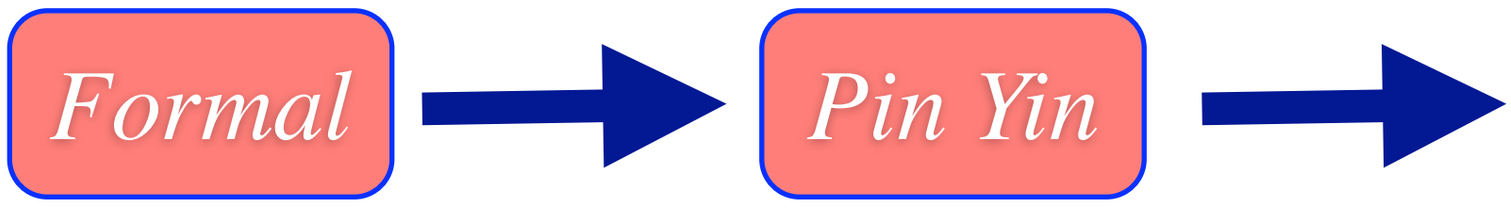

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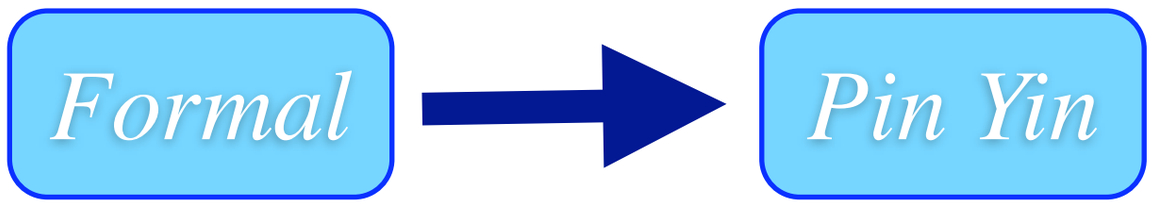

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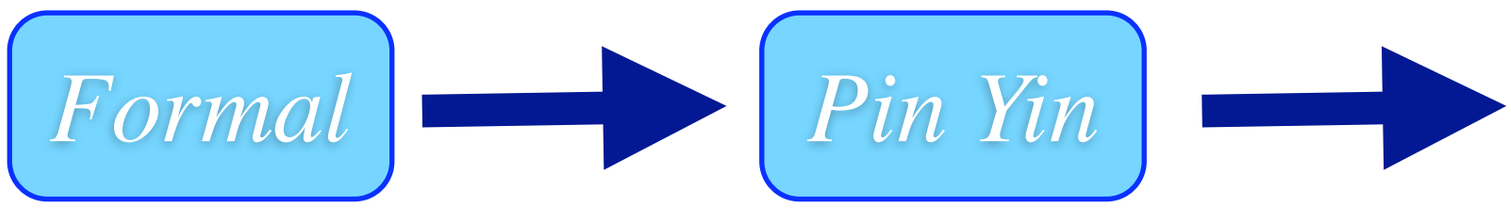

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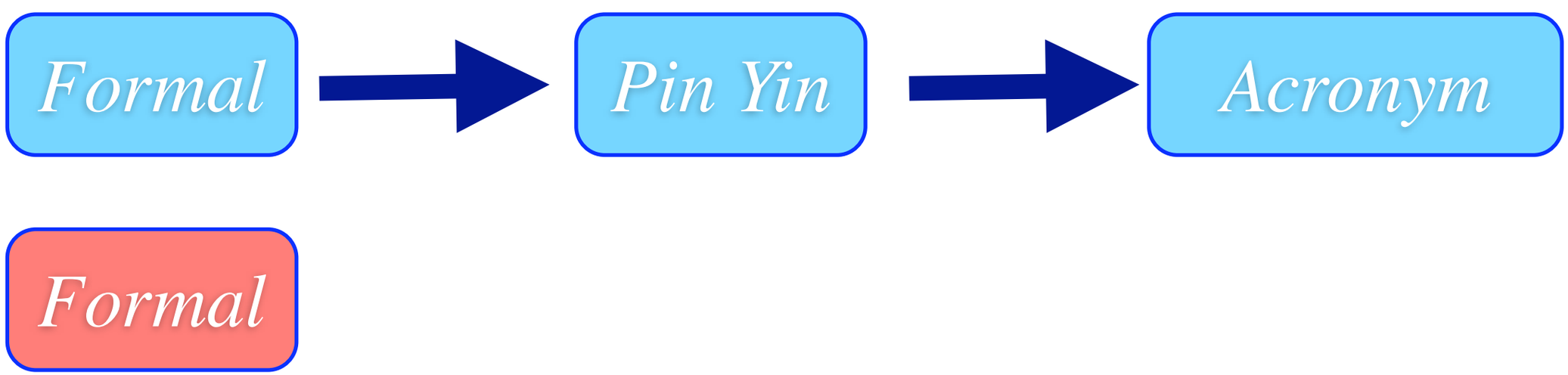

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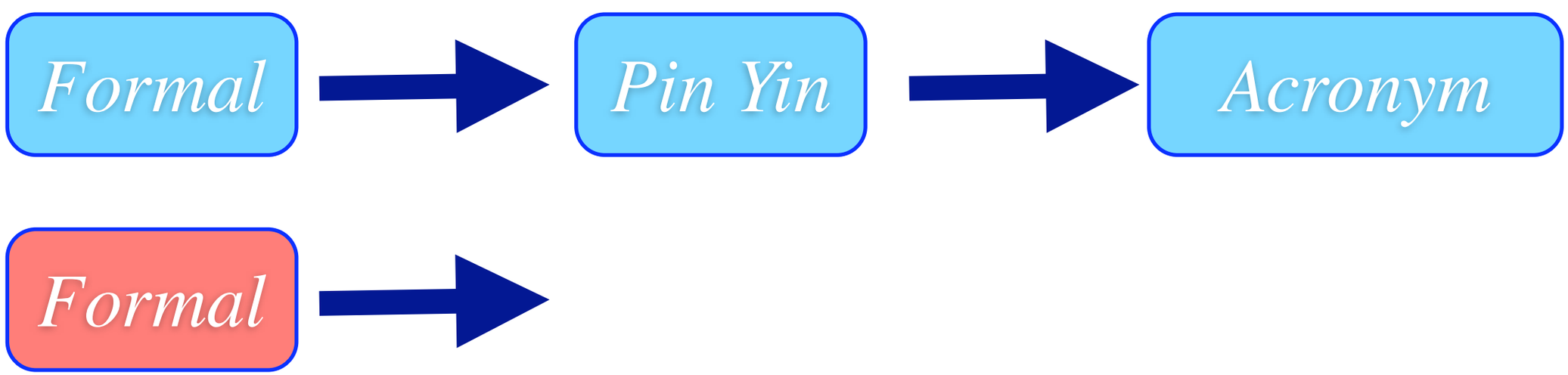

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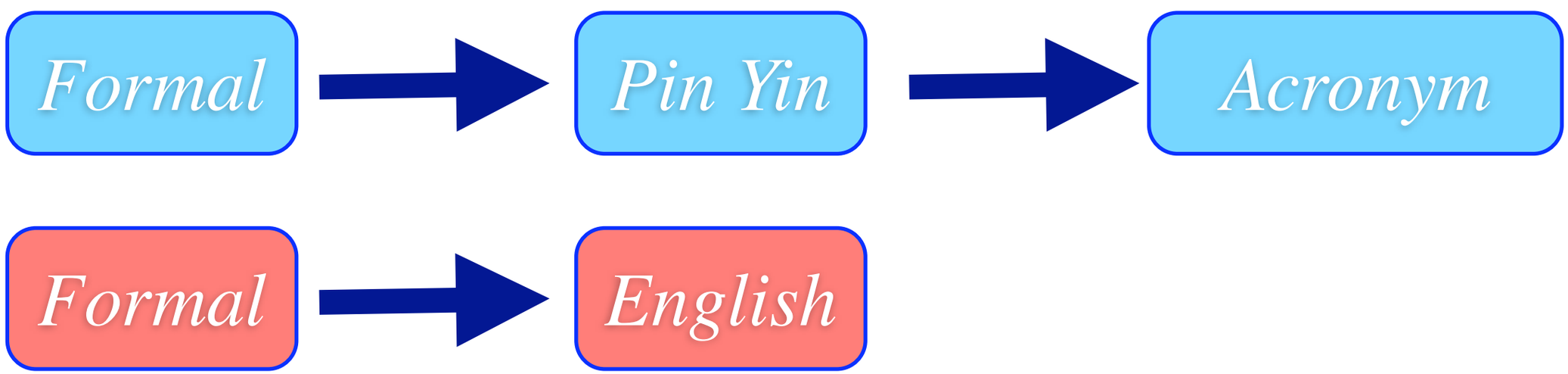

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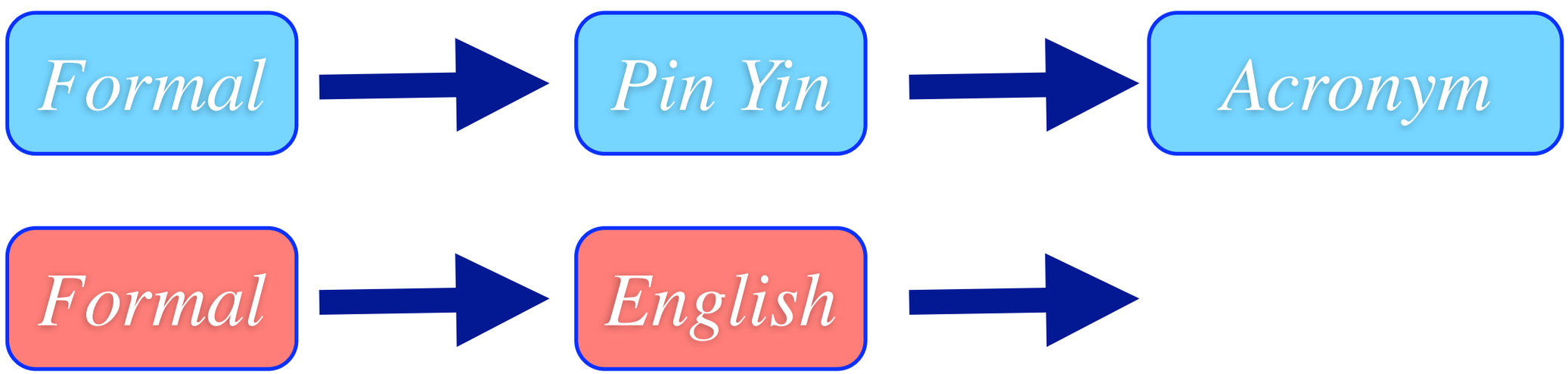

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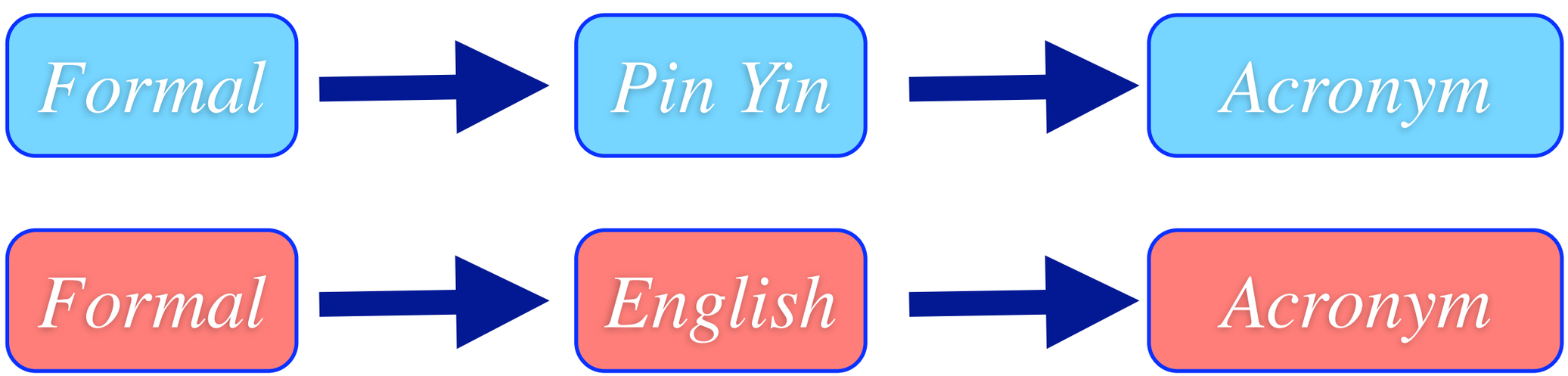

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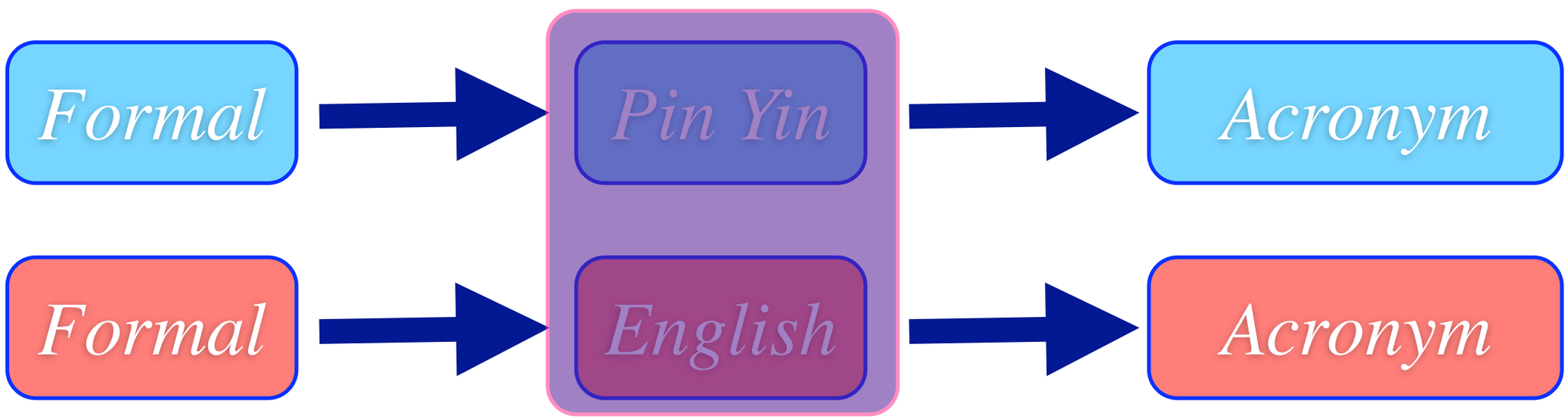

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歌迷 (GeMi)[fans]	粉丝 (FenSi)[a chinese food]	2 %
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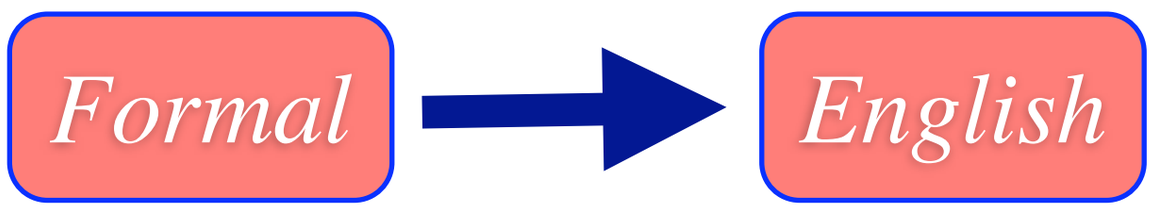

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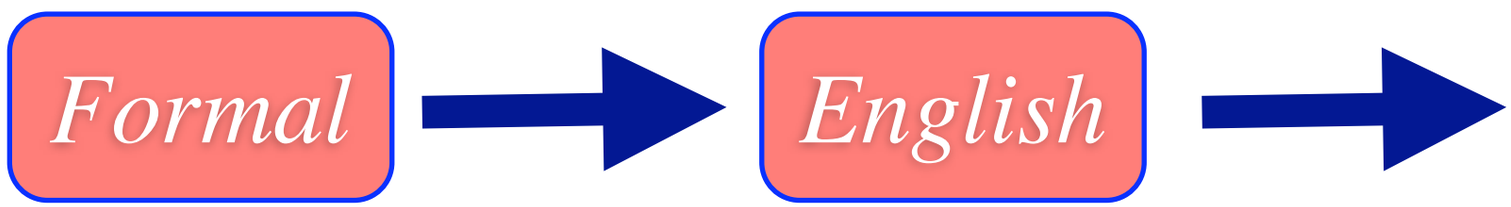

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Web users are very very creative!

Definitions in Real Text

- **In practice, the corresponding formal equivalent can sometimes be found near the informal phrases**
  - direct definitions
  - indirect associations

Direct Definitions

Definition Text	Relation
GF是女朋友的意思。	(女朋友, GF)
香港的食水采用世界卫生组织 (世卫)饮用水水质指引……	(世界卫生组织, 世卫)

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Pattern: *informal*是*formal* 的意思

Pattern: *formal*(*informal*)

Indirect Associations in Online Chat

⋮

Person A: 对不起， 我要先下线了, 拜拜

Person B: 88

Indirect Associations in Online Chat

⋮

Person A: 对不起， 我要先下线了,拜拜

Person B: 88

Indirect Associations in Online Chat

⋮

Person A: 对不起， 我要先下线了，拜拜

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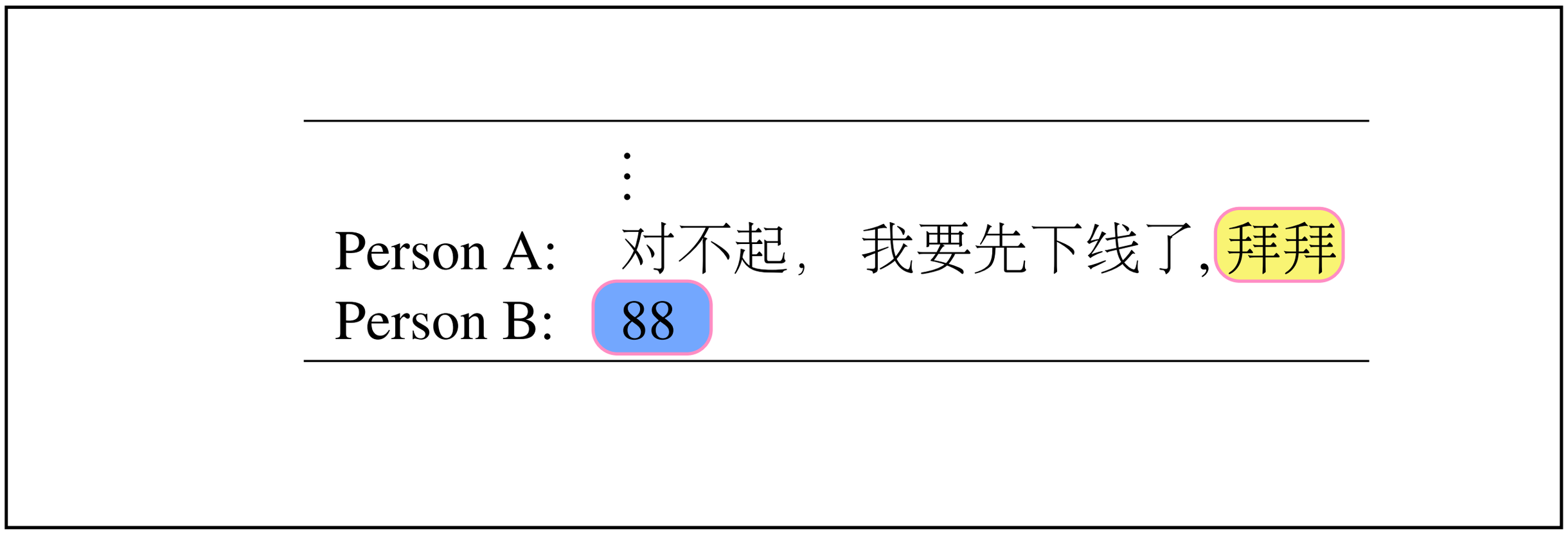
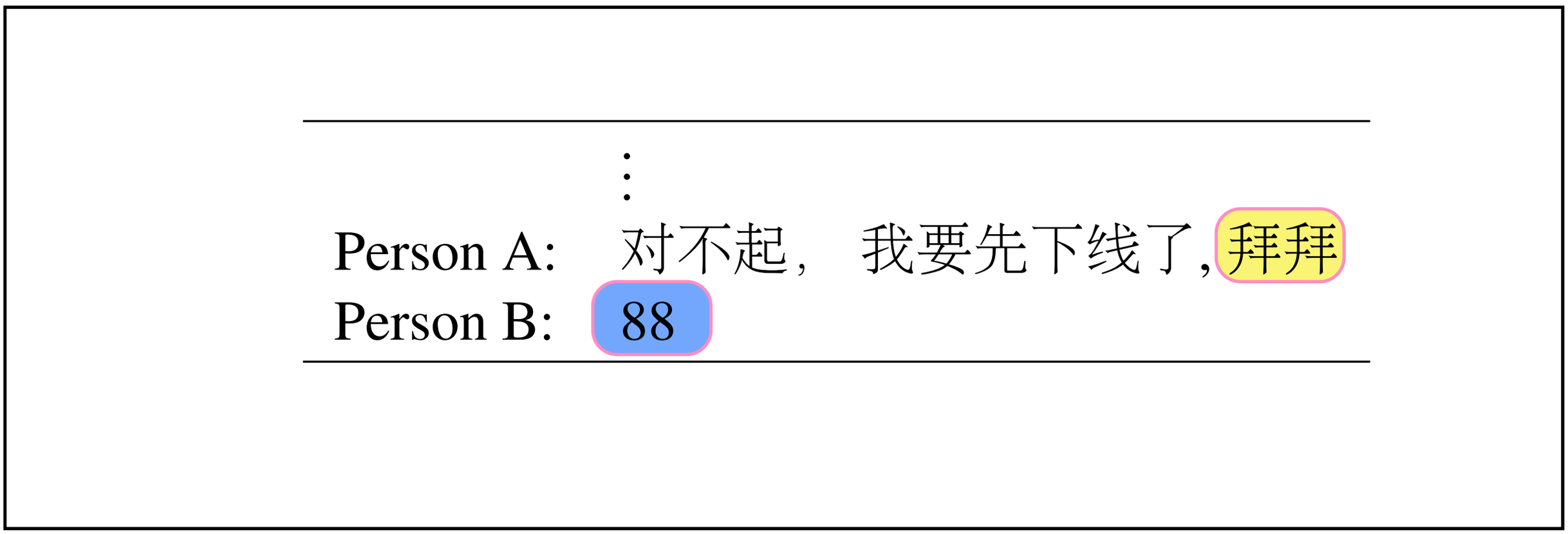
Indirect Associations in Online Chat



(拜拜， 88)

Indirect Associations in Online Chat



(拜拜， 88)

Bye bye

Indirect Associations in News Articles

Indirect Associations in News Articles

Title	都灵**冬奥会**开幕式将激情上演
Text	新华社都灵2月9日电(记者丁莹阎涛)第20届**冬季奥运会**的开幕式将于当地时间10日晚8点在都灵奥林匹克体育场正式揭开神秘的面纱。

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(冬季奥运会，冬奥会)

Winter Olympic Games

Mining Relations from the Web

Mining Relations from the Web

- **Identifying informal phrases**

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- **Identifying informal phrases**
- **For each informal phrase, identify its formal equivalent:**

Mining Relations from the Web

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  - Step-3: ranking hypotheses

Identifying informal phrases: bootstrapping

Identifying informal phrases: bootstrapping

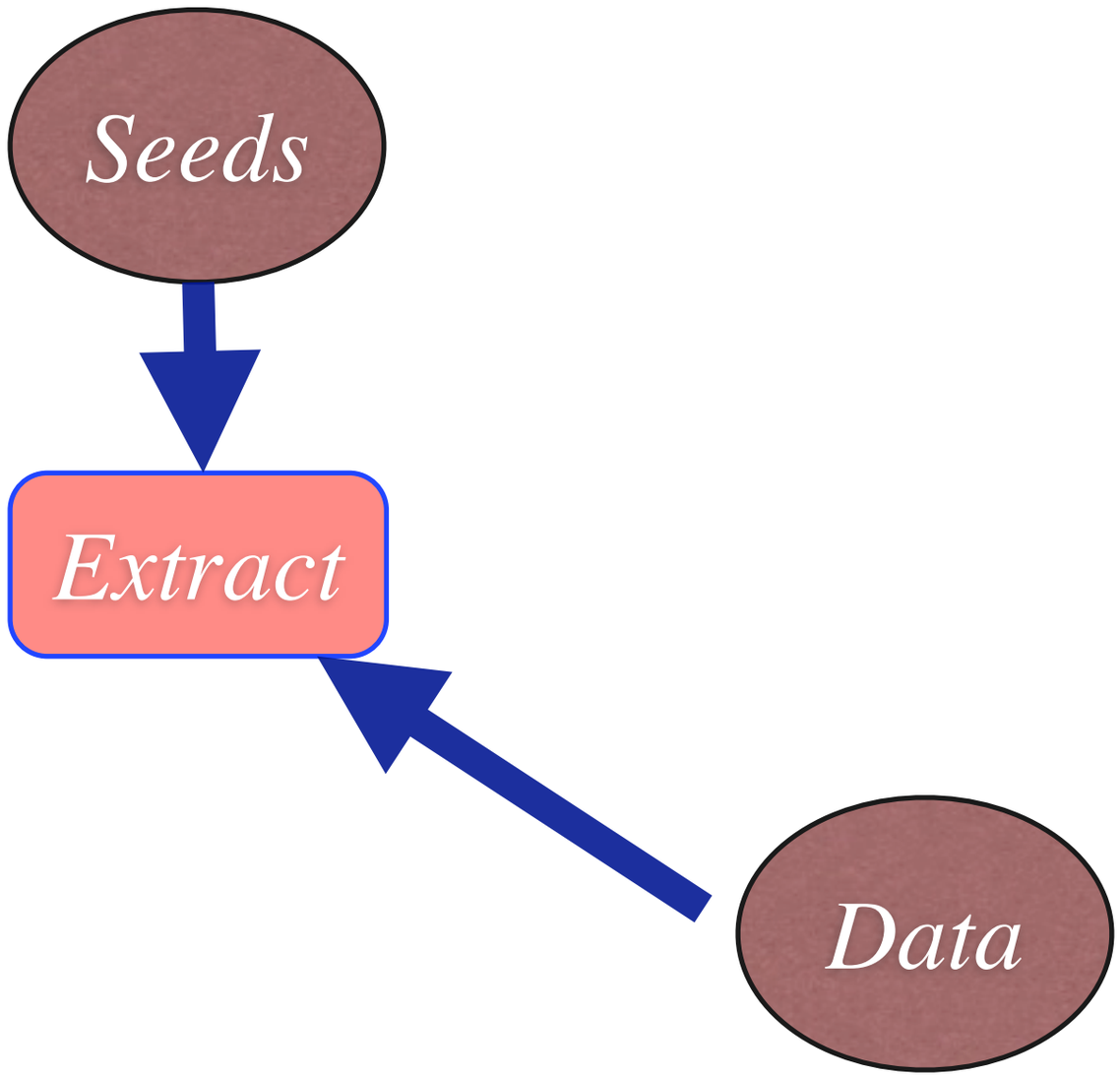
Seeds

Identifying informal phrases: bootstrapping

Seeds

Data

Identifying informal phrases: bootstrapping



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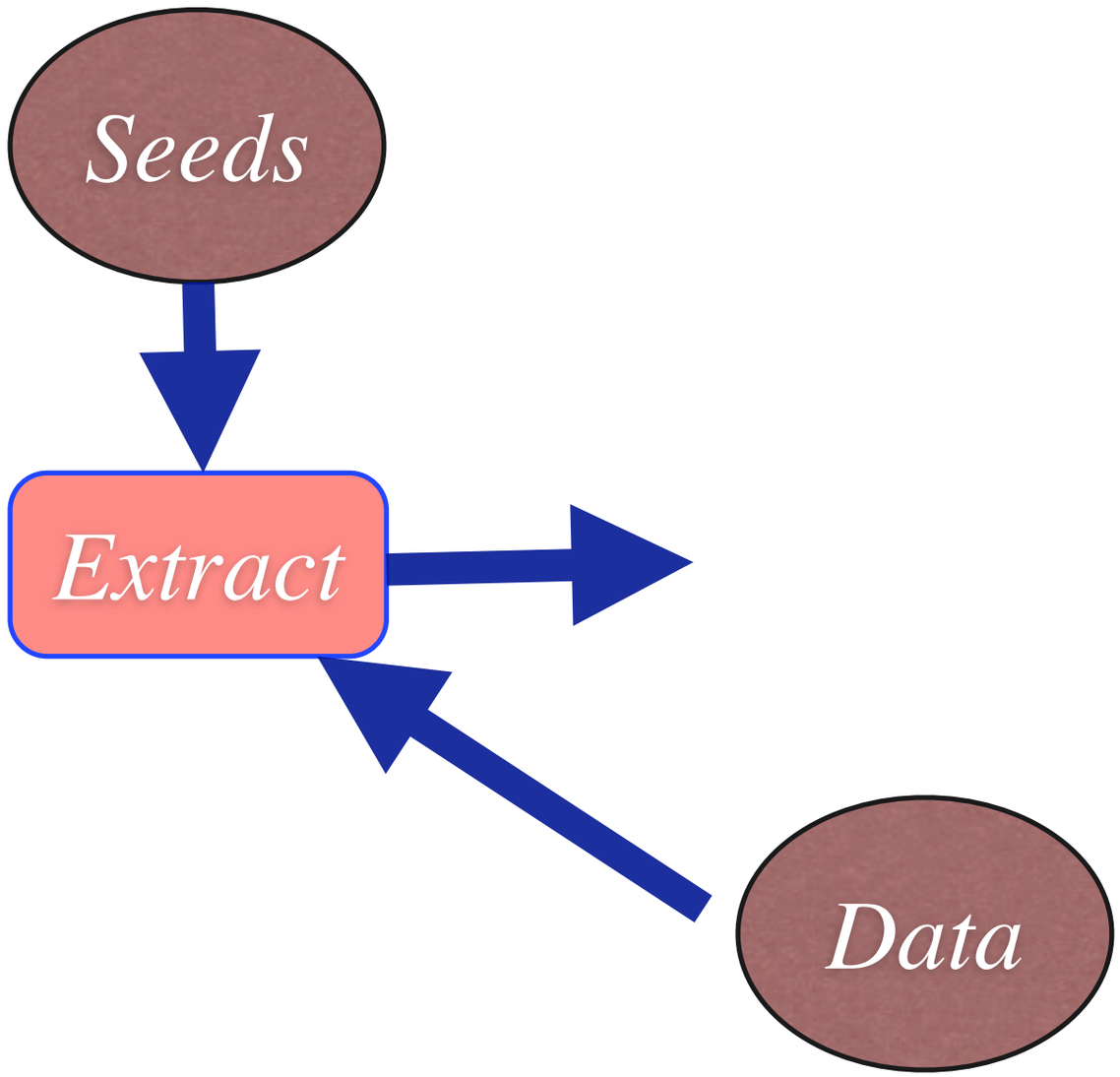

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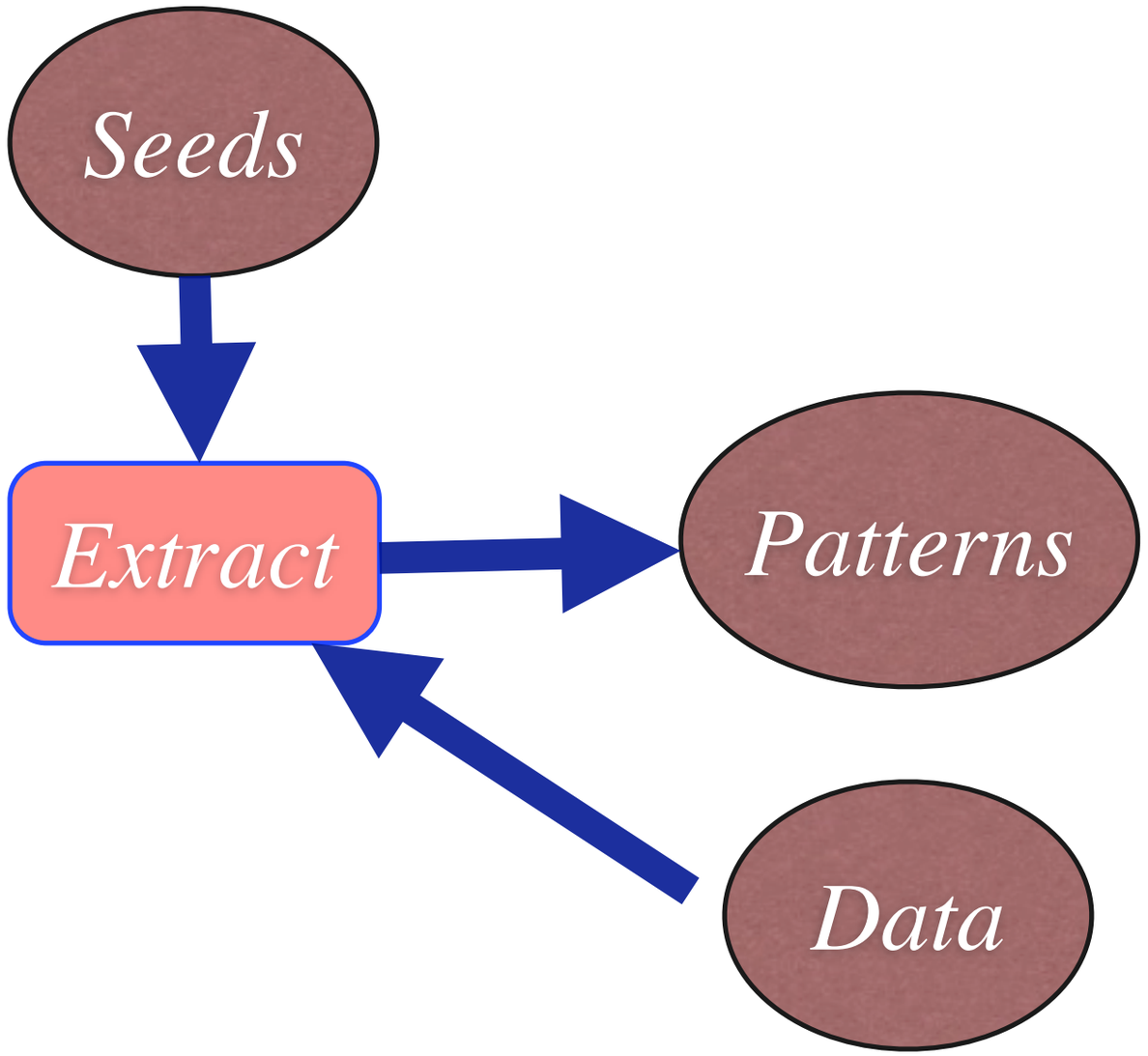

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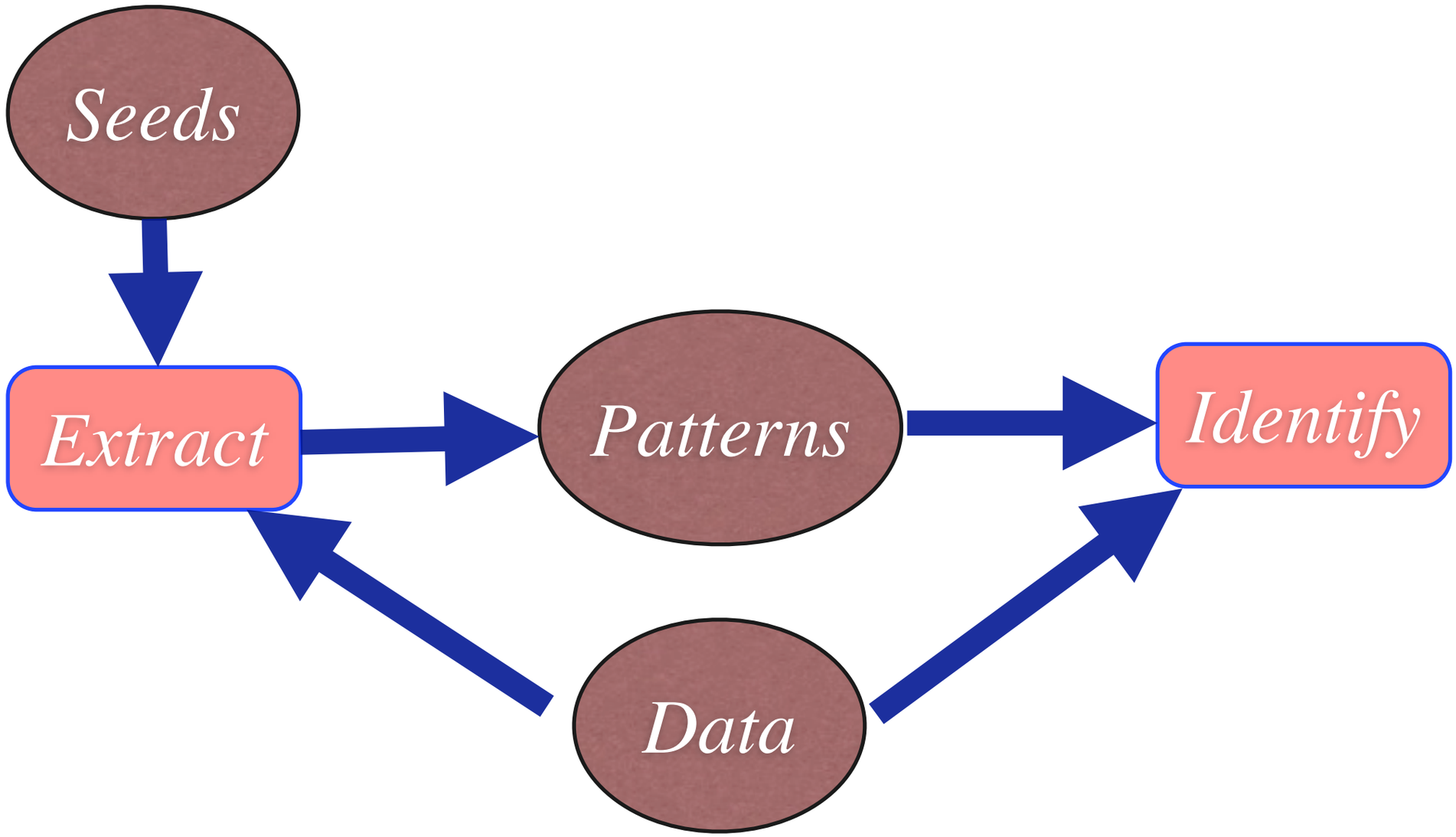

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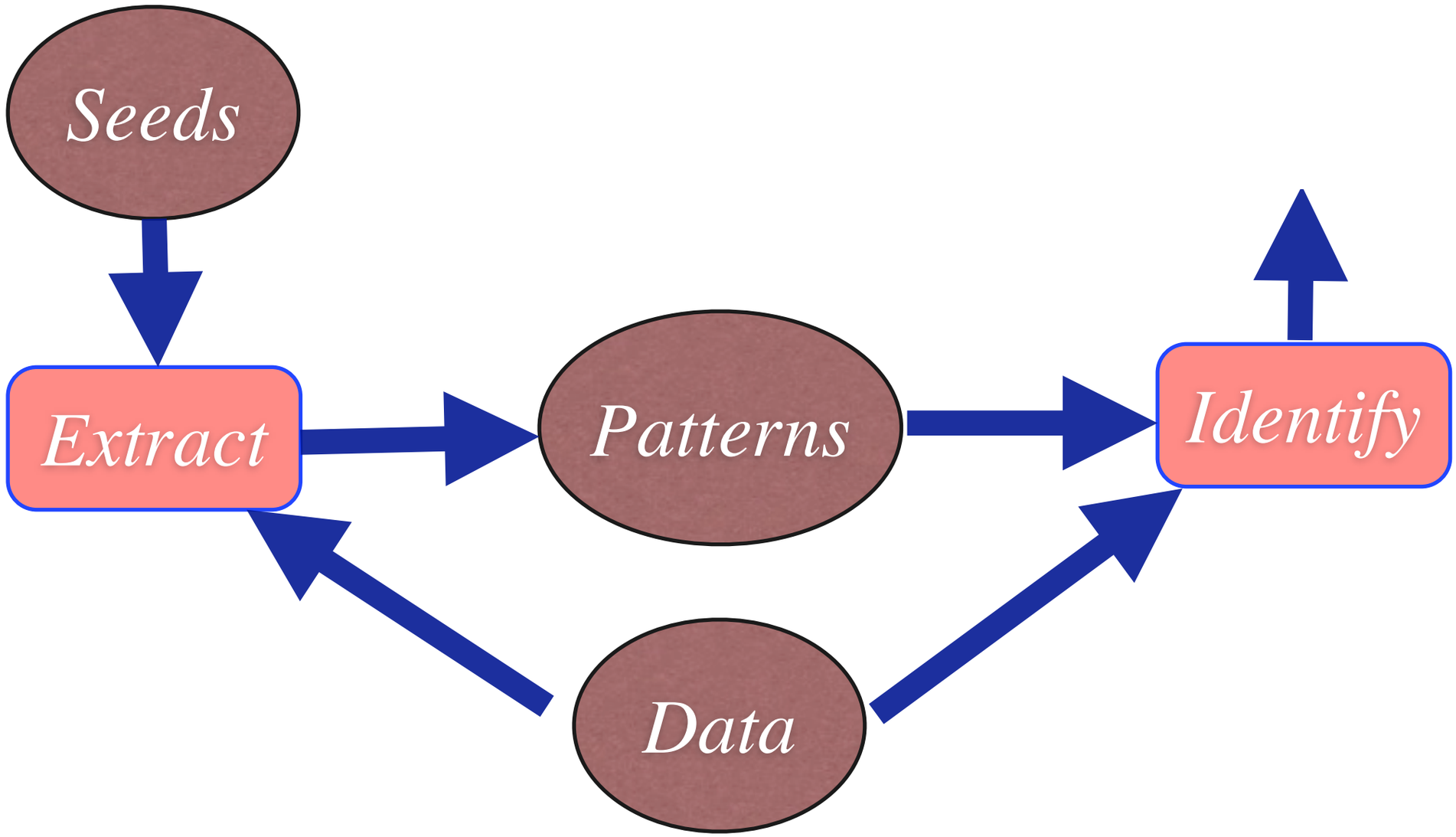
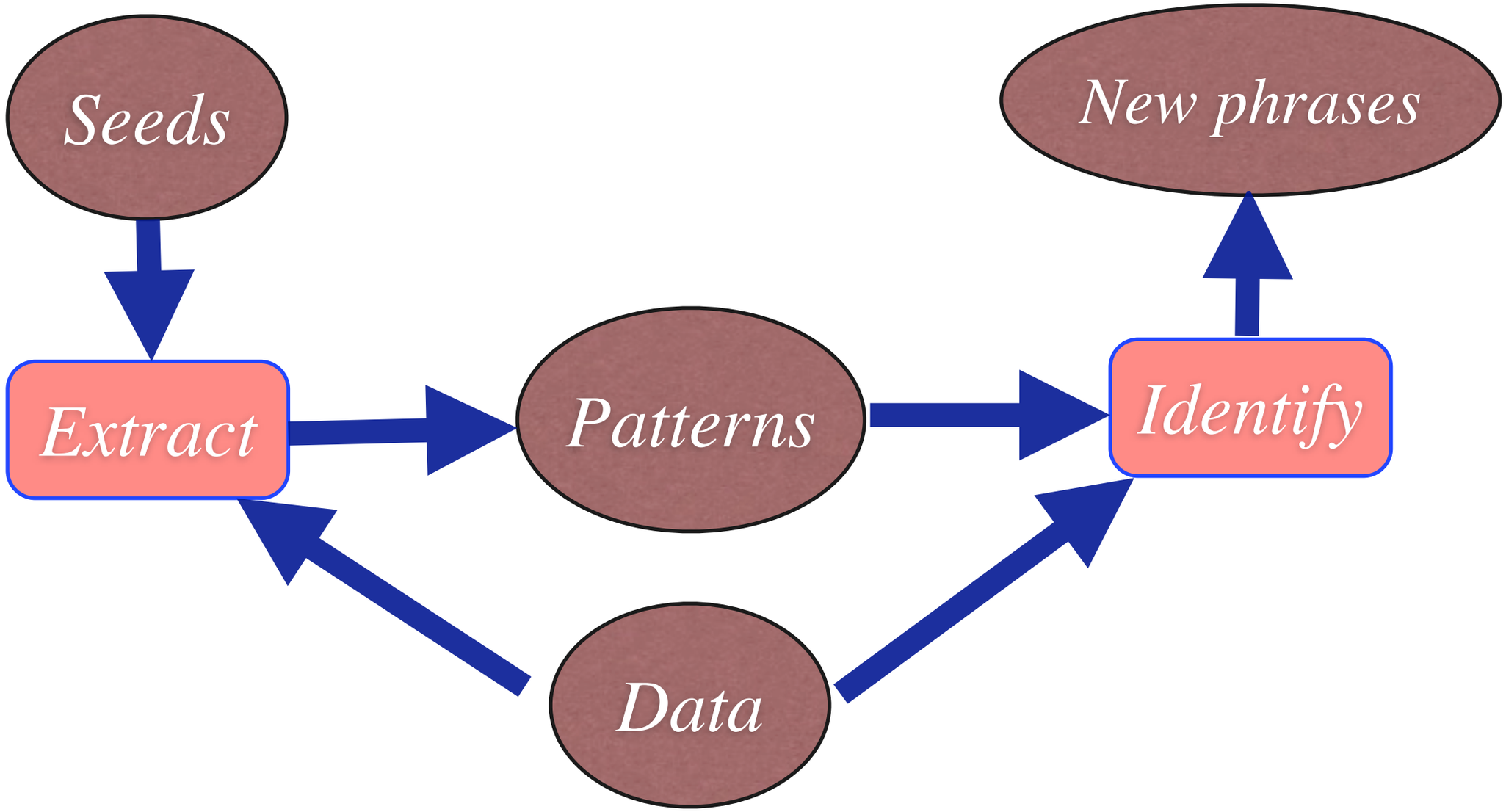
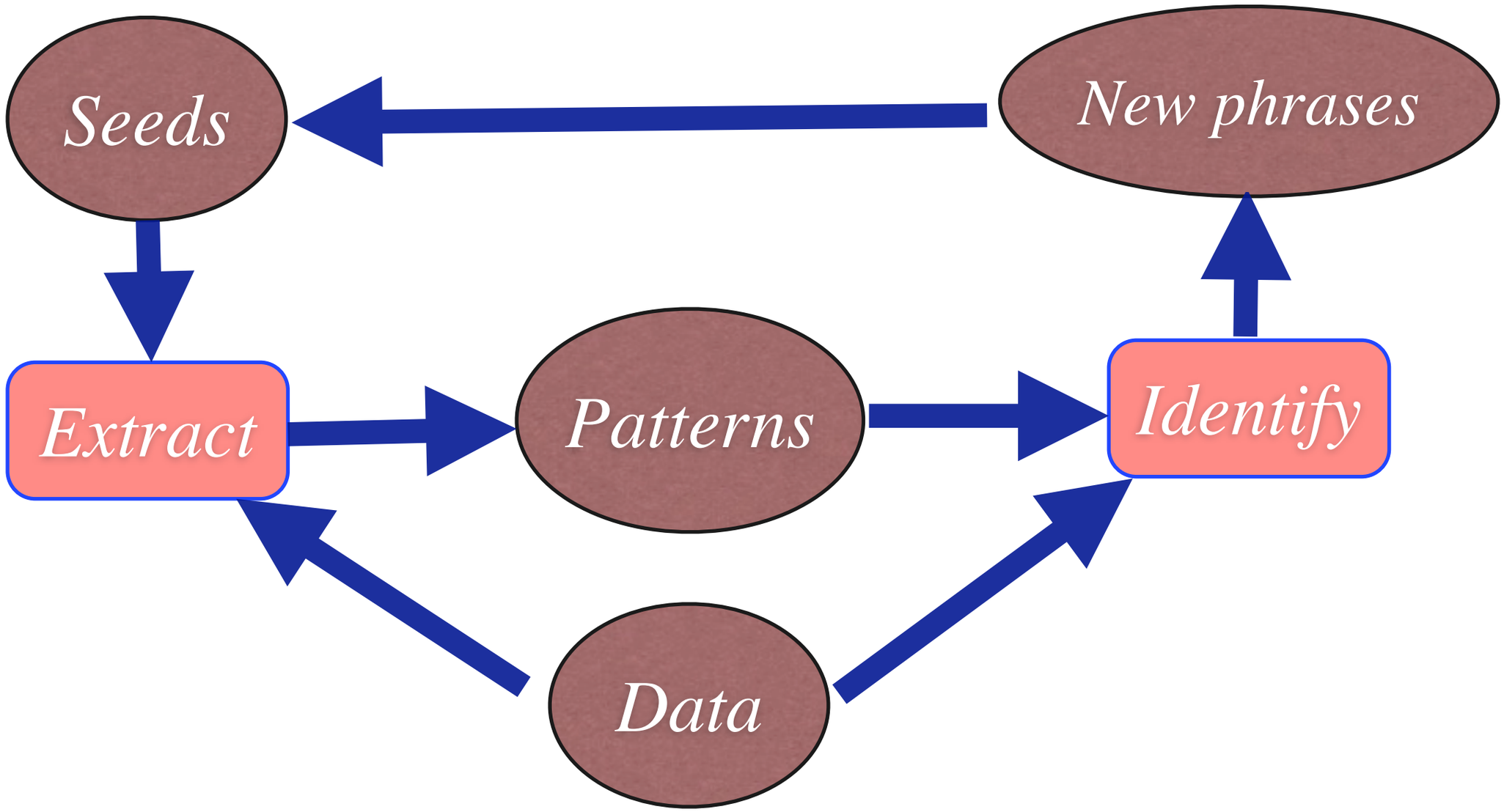


Identifying informal phrases: bootstrapping



Identifying informal phrases: bootstrapping



Seed: (GF,女朋友)

Seed: (GF,女朋友)

*GF*是女朋友的意思

稀饭是喜欢的意思

这是他们的意思

Seed: (GF,女朋友)

GF是女朋友的意思

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Pattern:

*informal*是*formal*的意思

Seed: (GF,女朋友)

GF是女朋友的意思

稀饭是喜欢的意思

这是他们的意思

Pattern:

*informal*是*formal*的意思

New relations:

Seed: (GF,女朋友)

GF是女朋友的意思

稀饭是喜欢的意思

这是他们的意思

Pattern:

*informal*是*formal*的意思

New relations:

(稀饭, 喜欢)

(gruel, like)

Seed: (GF,女朋友)

GF是女朋友的意思

稀饭是喜欢的意思

这是他们的意思

Pattern:

*informal*是*formal*的意思

New relations:

(稀饭, 喜欢)　　(gruel, like)

(这, 他们)　　(this, they)

Seed: (GF,女朋友)

GF是女朋友的意思

稀饭是喜欢的意思

这是他们的意思

Pattern:

*informal*是*formal*的意思

New relations:

(稀饭, 喜欢)

(这, 他们)

(gruel, like)

(this, they)

Step-1: Retrieving data from the Web

- **Given an informal phrase, we retrieve data from the Web**
  - search the informal phrase using a search engine (e.g., *www.baidu.com*)
    - *just search the informal phrase*
    - *search the informal phrase with domain information*
    - *use a search engine dedicated to informal text, e.g., blogsearch.baidu.com*
  - download the relevant webpages returned by the search engine

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Step-2: Generating Candidate Hypotheses

- **Data-driven hypothesis generation**
  - we extract n-grams occurring within a certain distance from the informal phrase

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*GF*是女朋友的意思

1-gram	*2-gram*
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朋	朋友
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1-gram	*2-gram*	*3-gram*
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朋	朋友	朋友的
友	友的	友的意
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- **Training**

$$\vec{\alpha}^* = \arg\max_{\vec{\alpha}} LL_R(\vec{\alpha})$$

Rule-driven Feature Functions

- **LD-PinYin(*x*,*y*)**
  - Levenshtein distance between PinYin of *x* and *y*
- **LEN-D-PinYin(*x*,*y*)**
  - Difference in the number of PinYin characters between *x* and *y*
- **Is-PinYin-Acronym(*x*,*y*)**
  - is *x* a PinYin acronym of *y*?
- **Is-CN-Abbreviation(*x*,*y*)**
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Is-CN-Abbreviation(美军,美国军队)=1,
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Data-driven Feature Functions

- **n-gram co-occurrence relative frequency**
  - how often *x* and *y* appear together?
- **Feature on a definition pattern**
  - Does co-occurrence of *x* and *y* follow a definition pattern?
- **Feature on the number of relevant webpages**
  - search the web using the pair of *x* and *y*
  - get the number of webpages returned

Results on Bootstrapping Informal Phrases

Size of seed set	130
Size of candidate set	3000
Size of test set	750
Recall	**30%**

Precisions on Relation Extraction

Category		Precision (%)			
		Top-1	Top-10	Top-50	Top-100
Homophone	Same PinYin	63.2	73.7	84.2	84.2
	Similar PinYin	40.0	60.0	70.0	80.0
	Number	81.1	91.6	95.8	96.8
Abbreviation	Chinese abbreviation	11.8	41.2	52.9	52.9
Acronym	PinYin Acronym	82.1	94.6	96.4	96.4
	English Acronym	21.9	46.9	56.3	59.4
Transliteration		20.0	40.0	50.0	50.0
Average		**61.8**	**77.1**	**83.1**	**84.7**

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Average (using data-driven features)		*51.4*	*71.1*	*81.1*	*82.7*

Summary

- We proposed an approach to extract relations between informal and formal Chinese phrases from Web corpora
- Our approach combines both rule and data-driven features
- The combinations of both rule and data-driven features outperforms the case just using only rule or data-driven features

Training and test examples are online at

http://www.cs.jhu.edu/~zfli

Thank you!