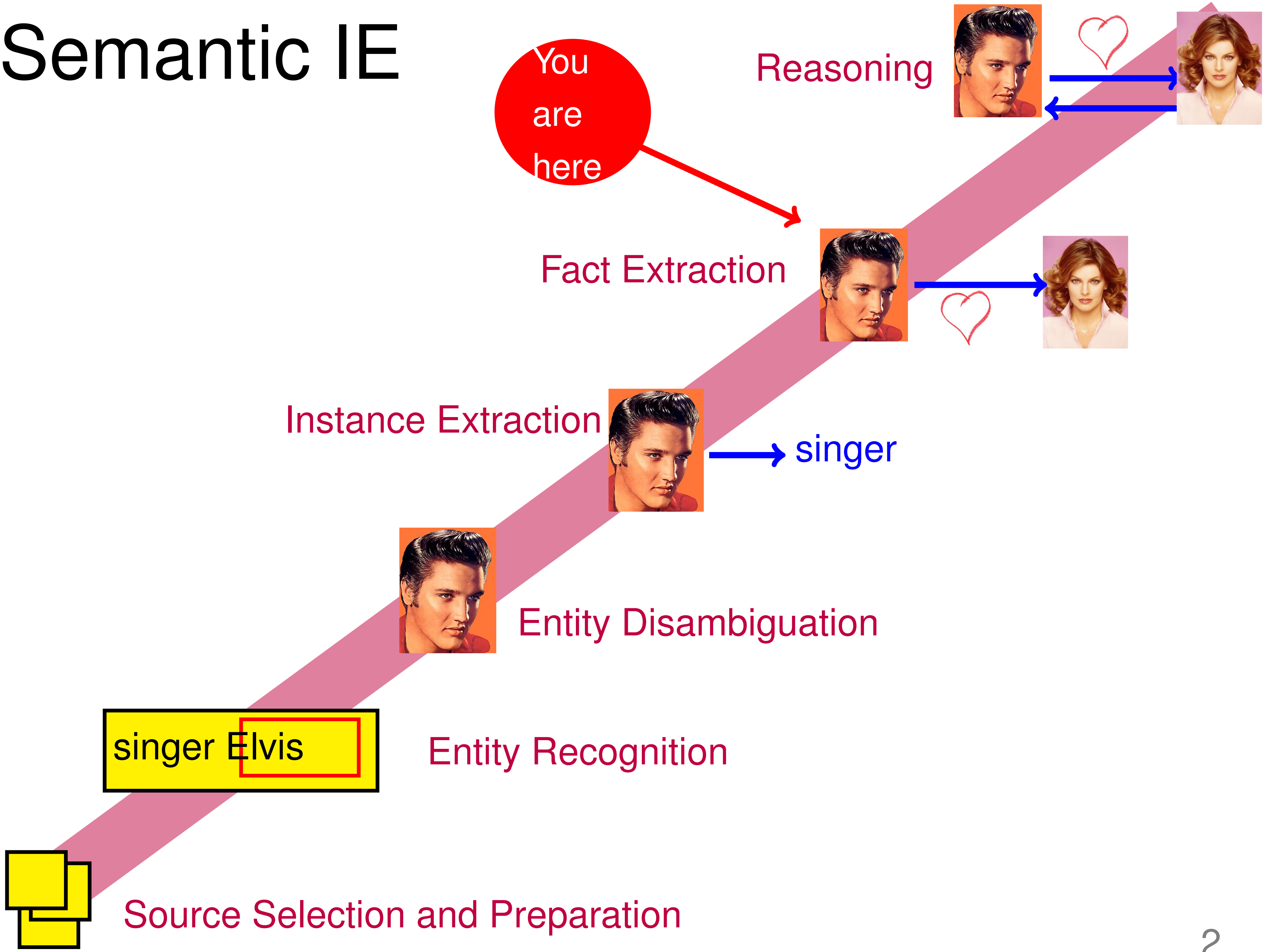
The DIPRE Algorithm

Fabian M. Suchanek

Semantic IE



You are here

Reasoning

Fact Extraction

Instance Extraction

singer

Entity Disambiguation

singer Elvis

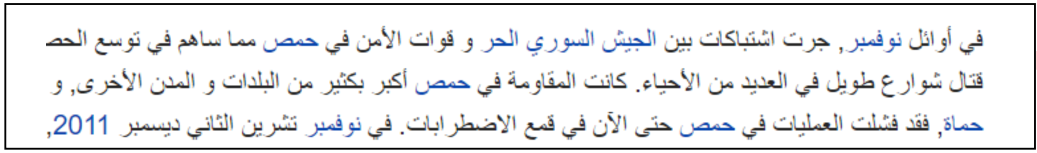
Entity Recognition

Source Selection and Preparation

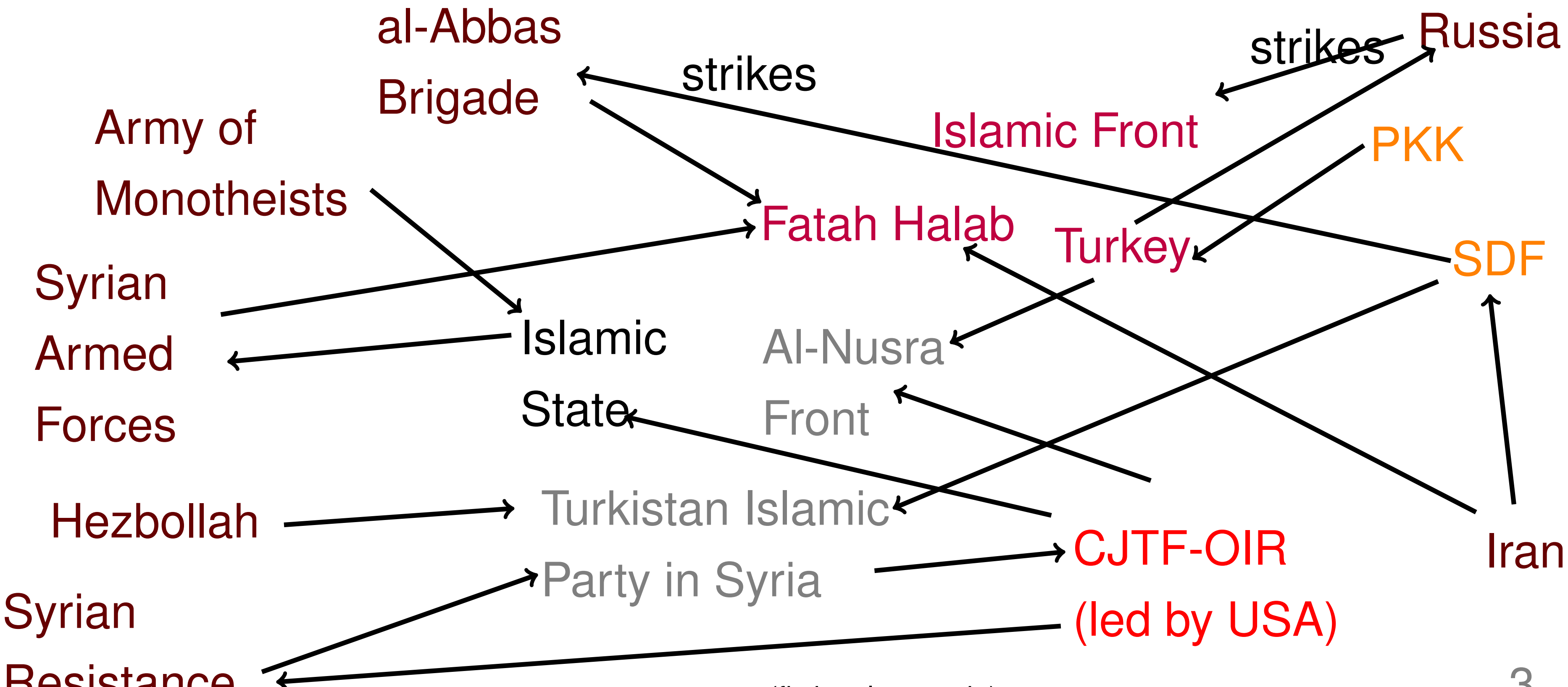
Def: Fact Extraction

Fact extraction is the extraction of facts about entities from a corpus.

For now, we concentrate on facts with a single relation.



في أوائل نوفمبر, جرت اشتباكات بين الجيش السوري الحر و قوات الأمن في حمص مما ساهم في توسع الحص
قتال شوارع طويل في العديد من الأحياء. كانت المقاومة في حمص أكبر بكثير من البلدات و المدن الأخرى, و
حماة, فقد فشلت العمليات في حمص حتى الآن في قمع الاضطرابات. في نوفمبر تشرين الثاني ديسمبر 2011,

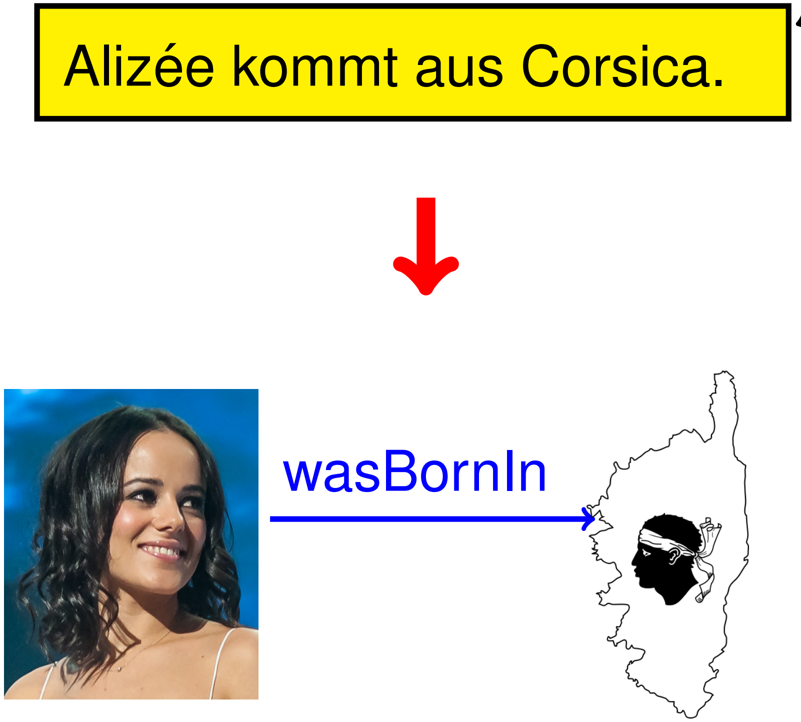


(fictional scenario)

Fact Extraction, happier example

Fact extraction is the extraction of facts about entities from a corpus.

For now, we concentrate on facts with a single relation.



Alizée kommt aus Corsica.

wasBornIn

For the computer, the corpus is completely incomprehensible — as if it were written in a foreign language!

The extracted facts, on the other hand, use well-defined relations.

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© -5-

Def: Extraction Pattern

An extraction pattern for a binary relation r is a string that contains two place-holders X and Y, indicating that two entities stand in relation r.

X kommt aus Y.

X wurde geboren in Y.

X stammt aus Y.

X ist gebürtig aus Y.

Extraction patterns

↓

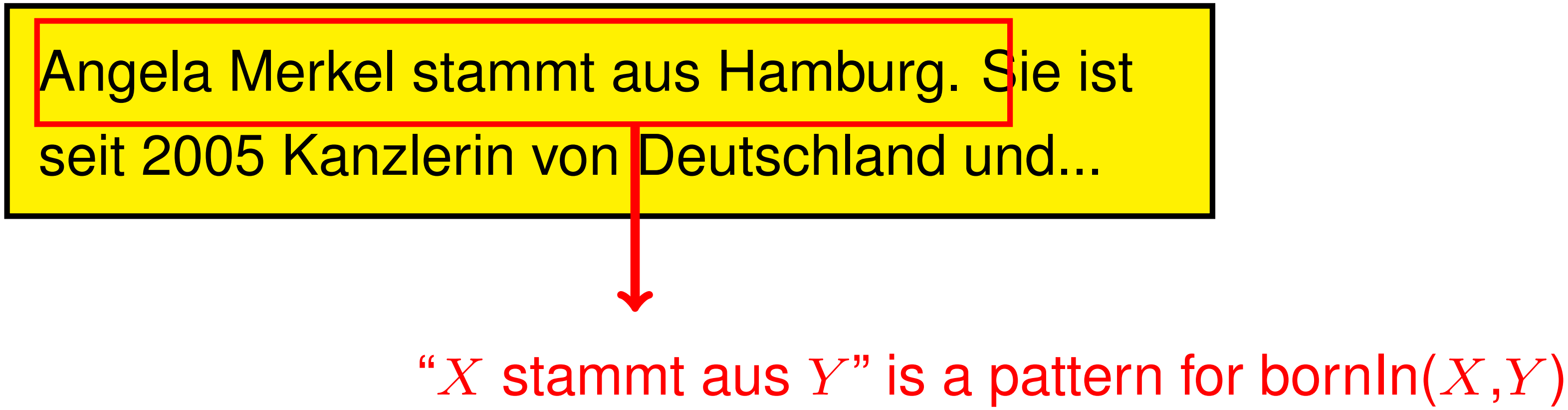
$$X \xrightarrow{\text{wasBornIn}} Y$$

Where do we get the patterns?

- Option 1: Manually compile patterns.

Public Domain

- Option 2: Manually find the patterns in texts



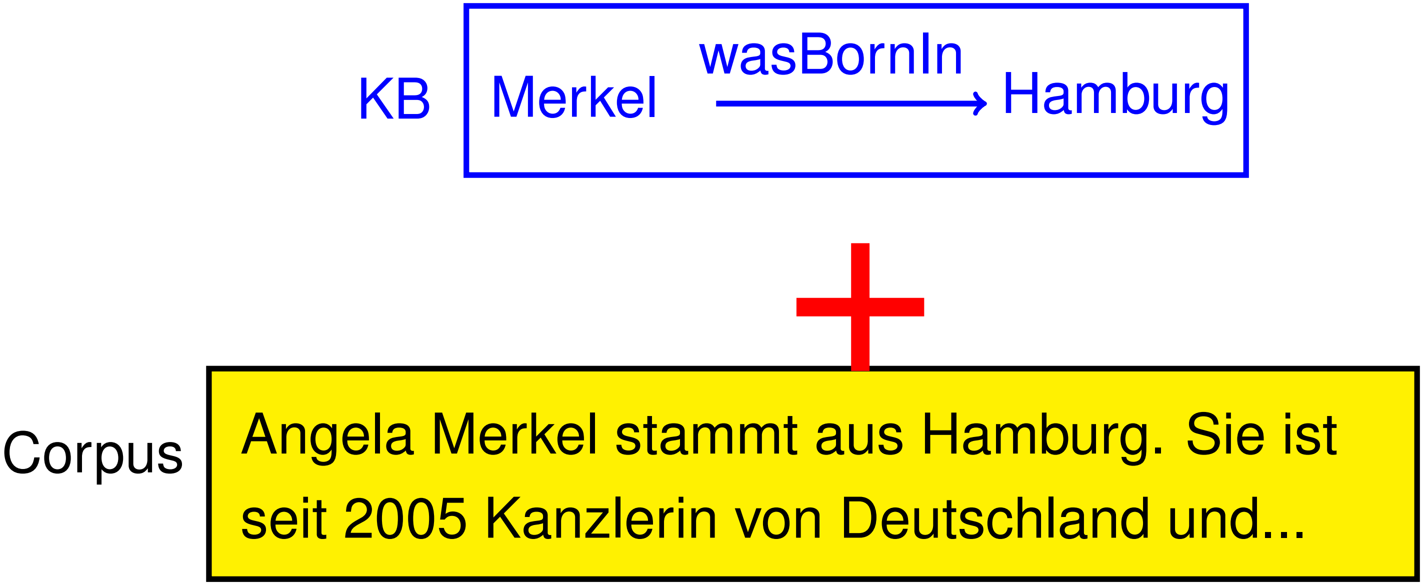
Angela Merkel stammt aus Hamburg. Sie ist seit 2005 Kanzlerin von Deutschland und...

"X stammt aus Y" is a pattern for bornIn(X,Y)

- Option 3: Pattern deduction

Def: Pattern Deduction

Given a corpus, and given a KB, pattern deduction is the process of finding extraction patterns that produce facts of the KB when applied to the corpus.



KB Merkel $\xrightarrow{\text{wasBornIn}}$ Hamburg

+

Corpus

Angela Merkel stammt aus Hamburg. Sie ist seit 2005 Kanzlerin von Deutschland und...

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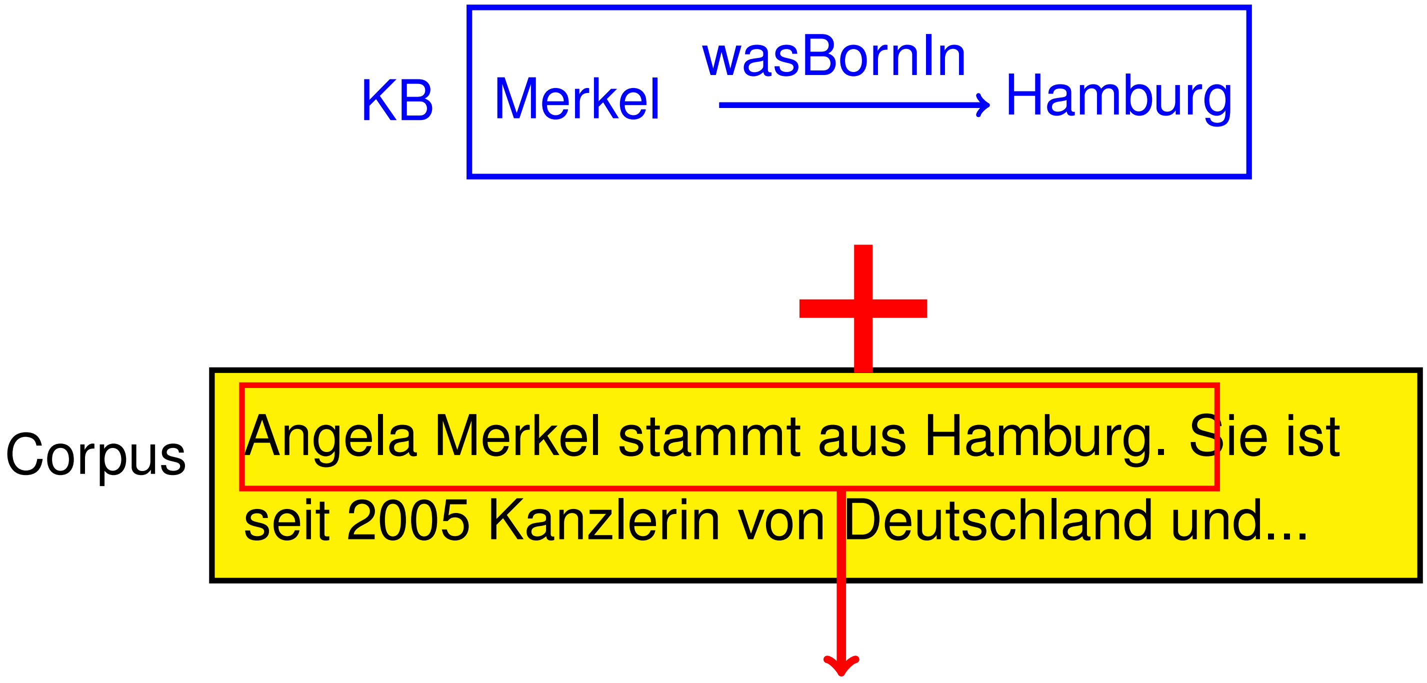

KB

Merkel $\xrightarrow{\text{wasBornIn}}$ Hamburg

Corpus

Angela Merkel stammt aus Hamburg. Sie ist seit 2005 Kanzlerin von Deutschland und...

“X stammt aus Y” is a pattern for bornIn(X,Y)

Def: Pattern Application

Given a corpus, and given a pattern, pattern application is the process of finding the facts produced by the pattern.

KB Merkel $\xrightarrow{\text{wasBornIn}}$ Hamburg

Corpus

Es ist klar: Alizée stammt aus Corsika. Die Sängerin wurde dort 1984 in Ajaccio...

“X stammt aus Y” is a pattern for bornIn(X,Y)

Def: Pattern Application

Given a corpus, and given a pattern, pattern application is the process of finding the facts produced by the pattern.

KB

Alizée $\xrightarrow{\text{wasBornIn}}$ Corsica

Merkel $\xrightarrow{\text{wasBornIn}}$ Hamburg

Corpus

Es ist klar: Alizée stammt aus Corsika. Die Sängerin wurde dort 1984 in Ajaccio...

+

“X stammt aus Y” is a pattern for bornIn(X,Y)

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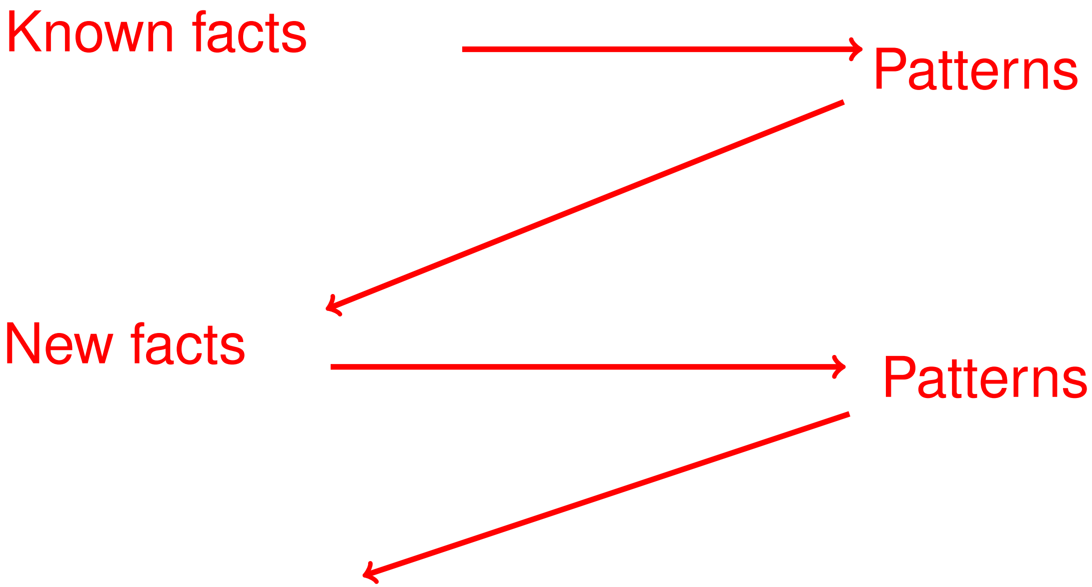
Def: Pattern iteration/DIPRE

Pattern iteration (also: DIPRE) is the process of repeatedly

- applying pattern deduction
- using the patterns to find new facts

... thus continuously augmenting the KB.



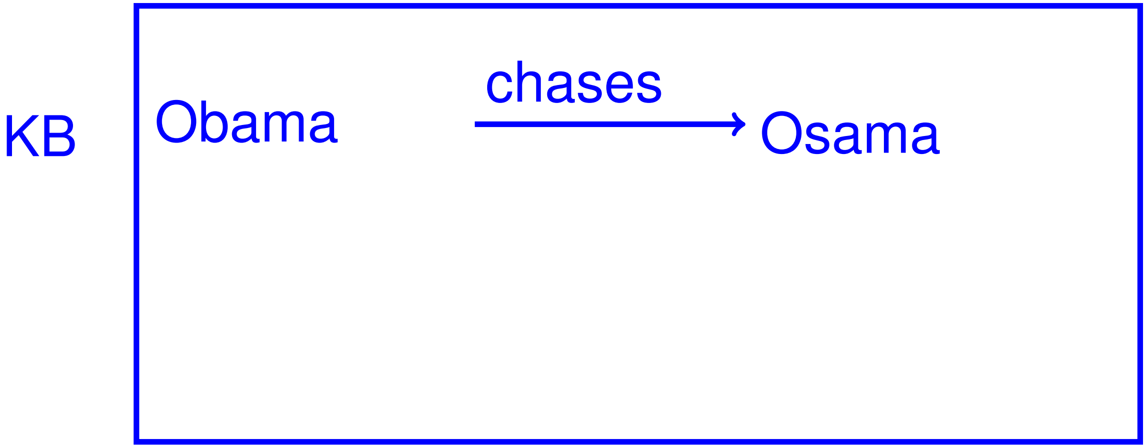
Known facts

Patterns

New facts

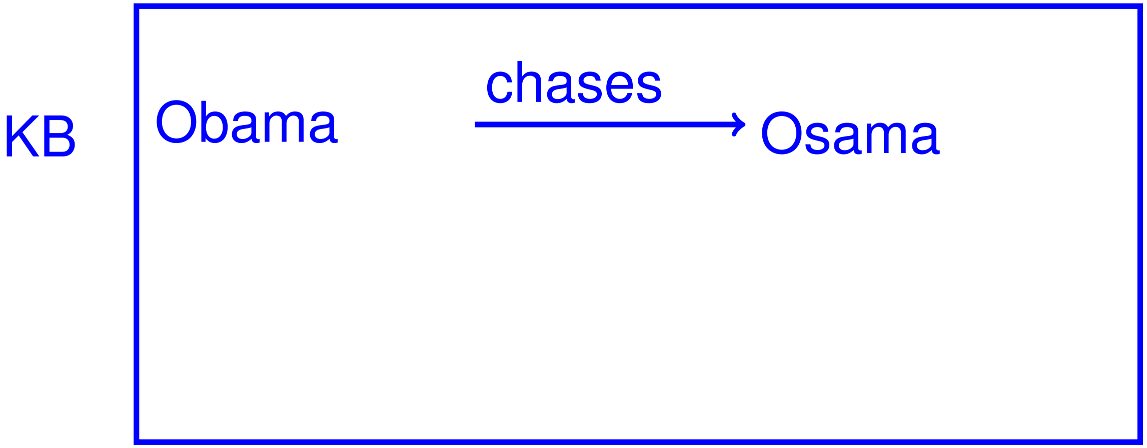
Patterns

Example: DIPRE



Obama hetzt Osama. Tom jagt Jerry. Tom hetzt Jerry.

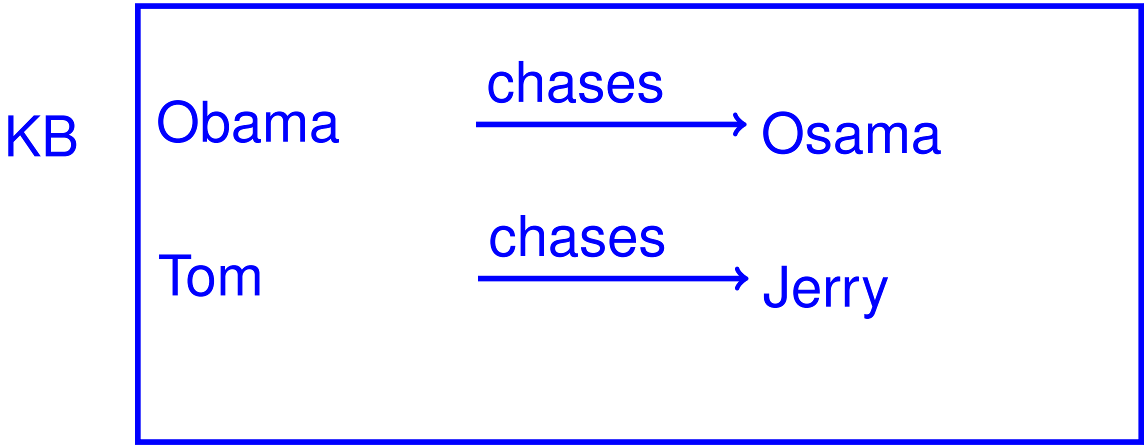
Example: DIPRE



Obama hetzt Osama. Tom jagt Jerry. Tom hetzt Jerry.

=> “X hetzt Y” is a pattern for chases(X, Y)

Example: DIPRE



KB

Obama chases Osama

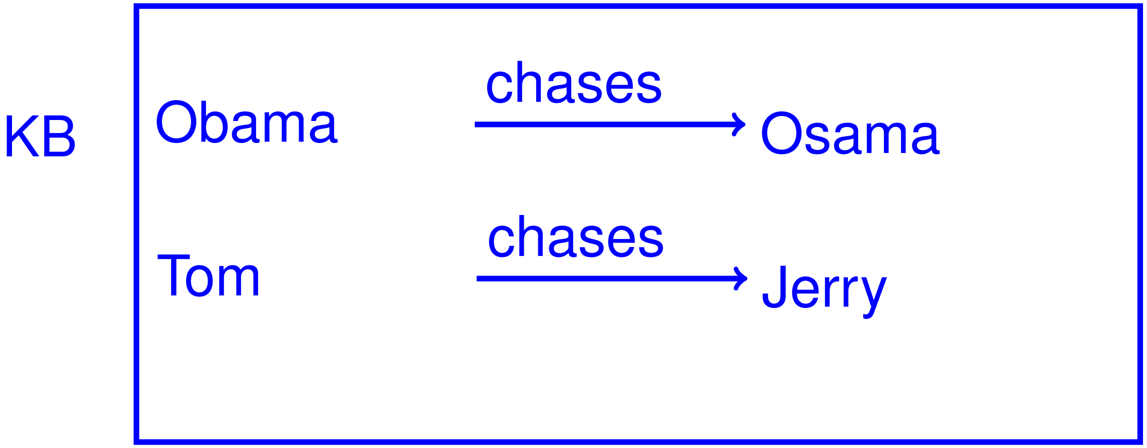
Tom chases Jerry

Obama hetzt Osama. Tom jagt Jerry. Tom hetzt Jerry.

=> “X hetzt Y” is a pattern for chases(X, Y)

© momokacma, William Hanna and Joseph Barbera

Example: DIPRE



Obama hetzt Osama. Tom jagt Jerry. Tom hetzt Jerry.

=> “X hetzt Y” is a pattern for chases(X, Y)

=> “X jagt Y” is a pattern for chases(X, Y)

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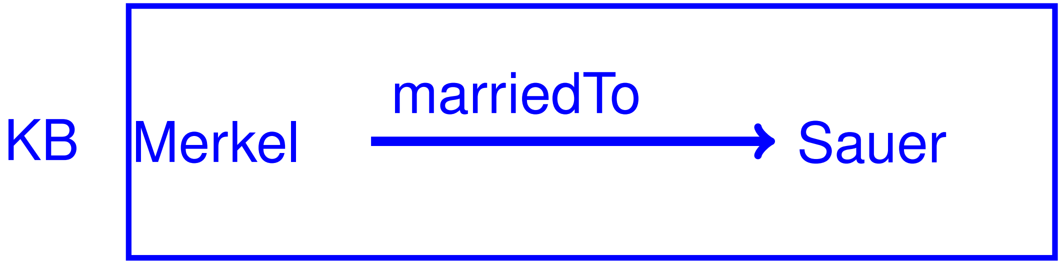
Task: DIPRE



Michelle ist verheiratet mit Barack.

Merkel ist die Frau von Sauer.

Michelle ist die Frau von Barack.

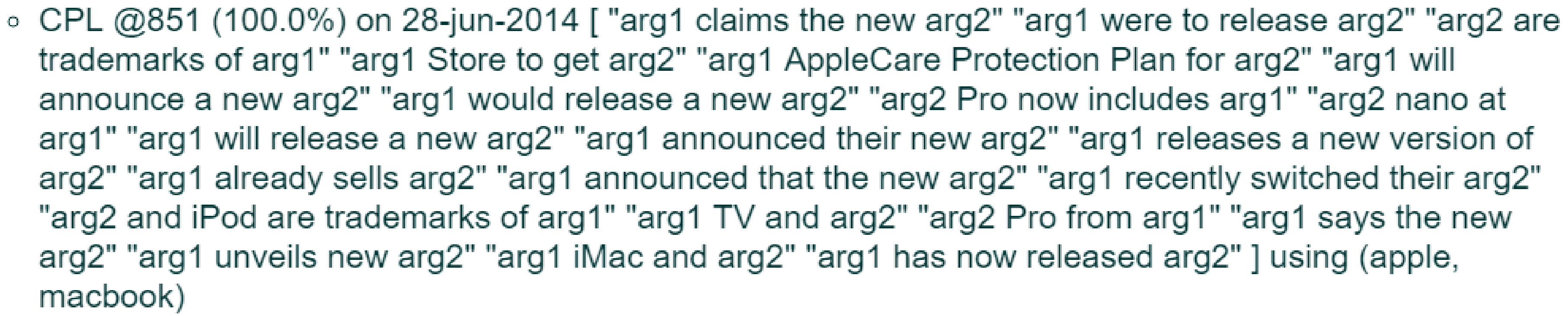
Priscilla ist verheiratet mit Elvis.

we can deduce that :
Michell —marriedTo—> Barack
Priscilla —marriedTo —> Elvis

Example: Patterns in NELL

NELL (Never Ending Language Learner) is an information extraction project at Carnegie Mellon University.

Apple $\xrightarrow{\text{produced}}$ MacBook



- CPL @851 (100.0%) on 28-jun-2014 ["arg1 claims the new arg2" "arg1 were to release arg2" "arg2 are trademarks of arg1" "arg1 Store to get arg2" "arg1 AppleCare Protection Plan for arg2" "arg1 will announce a new arg2" "arg1 would release a new arg2" "arg2 Pro now includes arg1" "arg2 nano at arg1" "arg1 will release a new arg2" "arg1 announced their new arg2" "arg1 releases a new version of arg2" "arg1 already sells arg2" "arg1 announced that the new arg2" "arg1 recently switched their arg2" "arg2 and iPod are trademarks of arg1" "arg1 TV and arg2" "arg2 Pro from arg1" "arg1 says the new arg2" "arg1 unveils new arg2" "arg1 iMac and arg2" "arg1 has now released arg2"] using (apple, macbook)

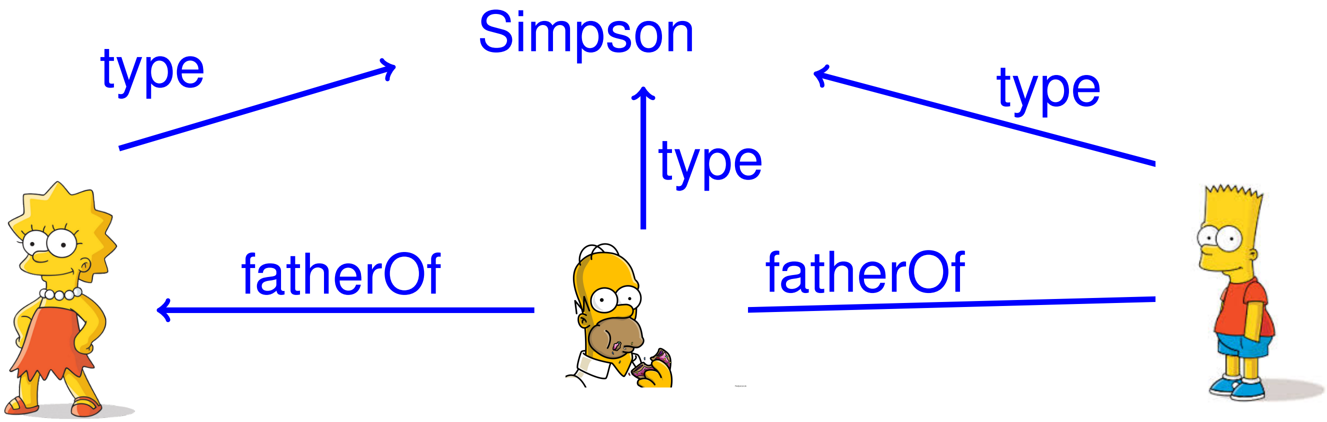
>skip summary

NELL: MacBook

Summary: Information Extraction

Congratulations, you can now transform (parts of) natural language text into structured information!

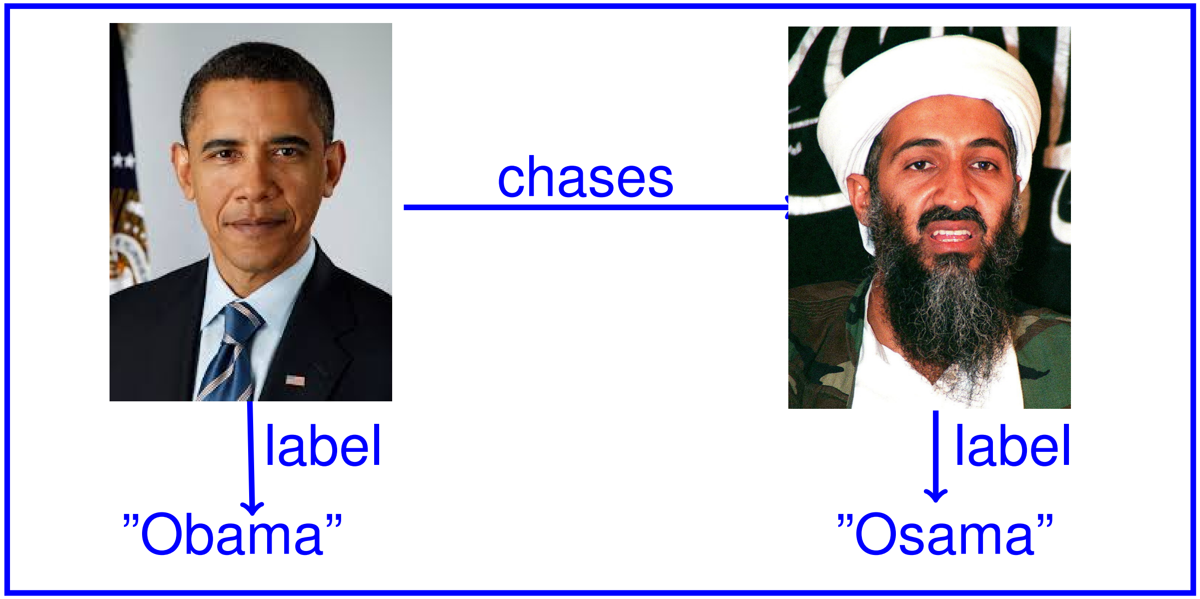
I love Simpsons such as Bart, Lisa, and Homer.
Homer is the father of Bart.
Homer is the father of Lisa.



>Problems

We use labels to find patterns

KB



chases

label

”Obama”

label

”Osama”

Corpus

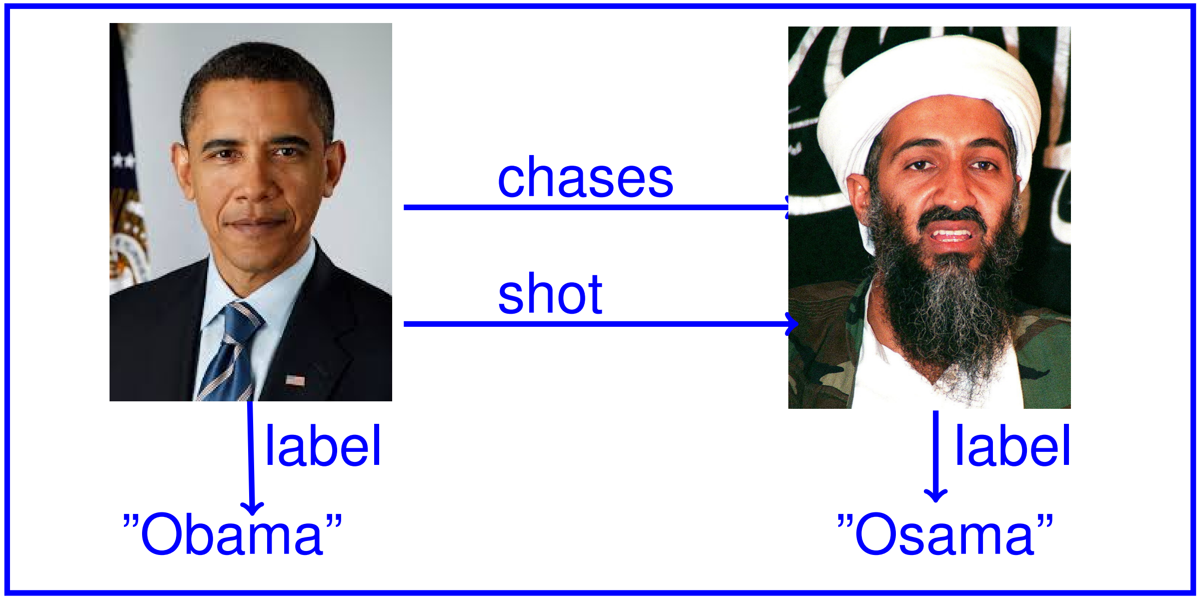
Obama verfolgt Osama.

=> “X verfolgt Y” is a pattern for chases(X,Y)

>Problems

Different Relations

KB



chases

shot

label

"Obama"

label

"Osama"

Corpus

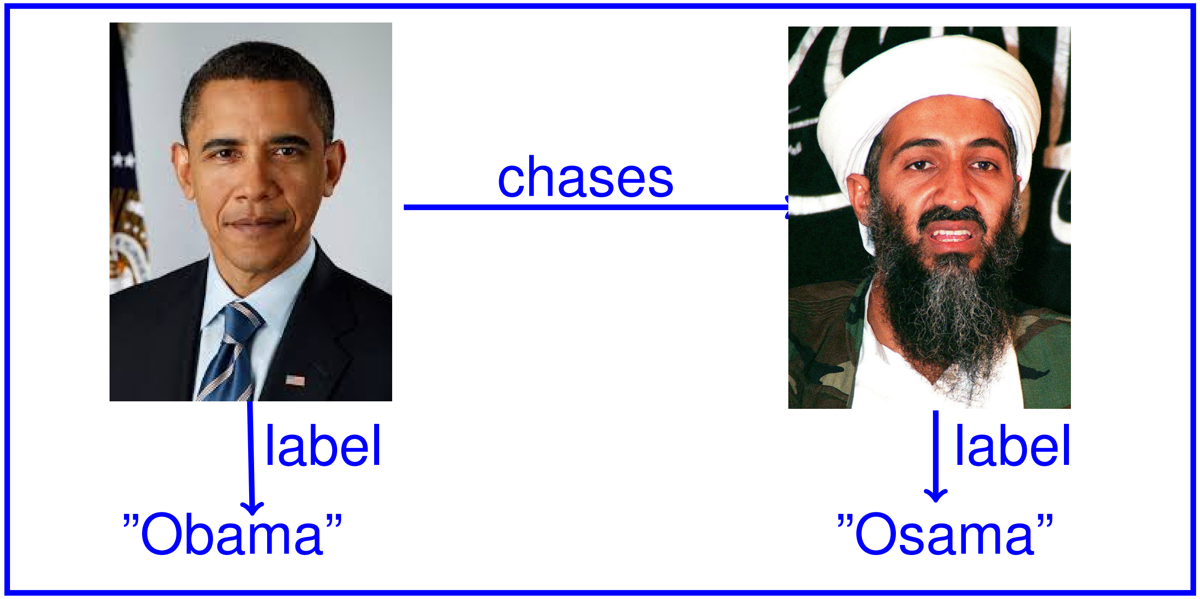
Obama verfolgt Osama.

=> "X verfolgt Y" is a pattern for chases(X,Y) for shot(X,Y)?

>Problems

Phrase Structure can be a Problem

KB



chases

label

"Obama"

label

"Osama"

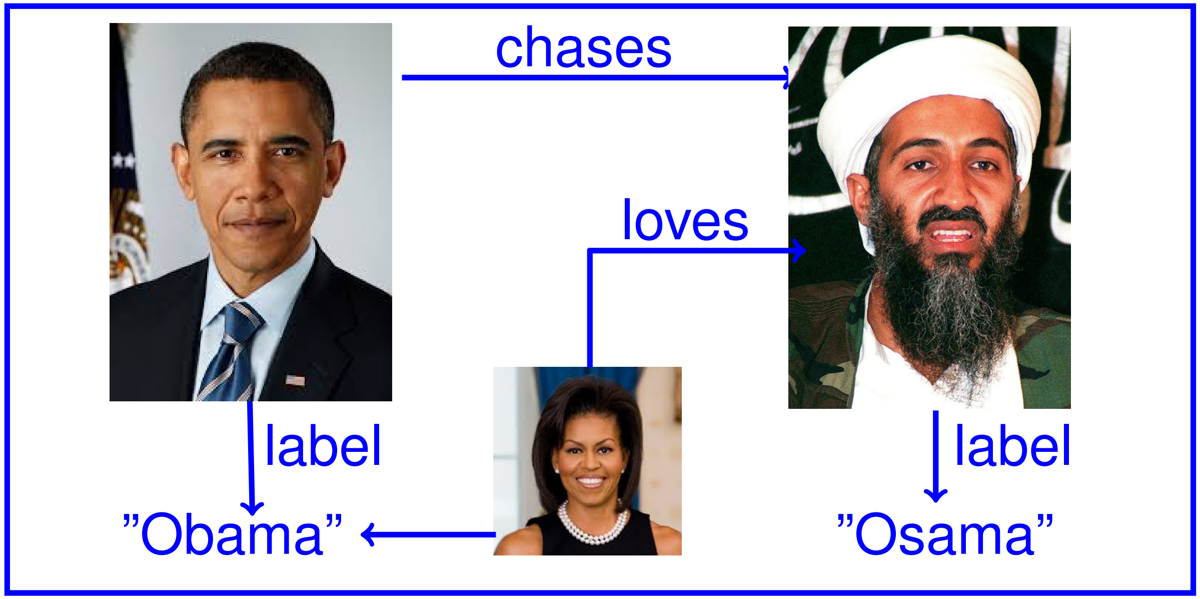
Corpus

Obama hat Osama verfolgt.

=> “X hat Y” is a pattern for chases(X,Y)?

Ambiguity is a Problem

KB



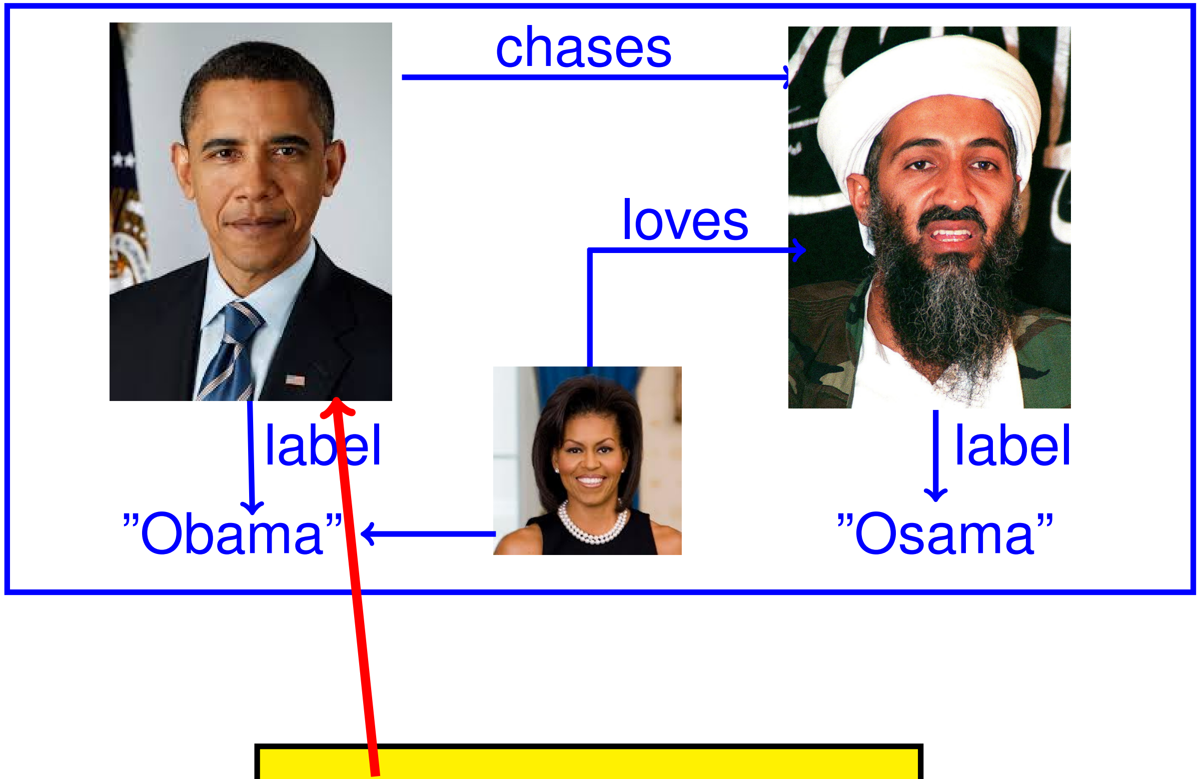
Corpus

Obama verfolgt Osama.

=> "X verfolgt Y" is a pattern for chases(X,Y) for loves(X,Y)?

Disambiguation helps

KB



chases

loves

label

"Obama"

label

"Osama"

Corpus

Obama verfolgt Osama.

=> "X verfolgt Y" is a pattern for chases(X,Y)

Confidence of a pattern

The confidence of an extraction pattern is the number of matches that produce known facts divided by the total number of matches.

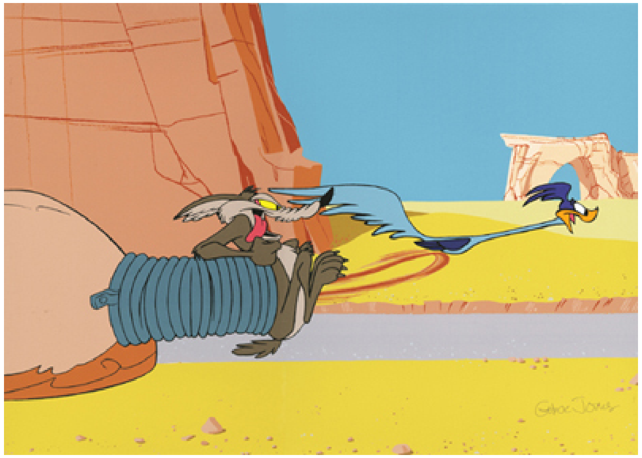
Pattern produces mostly new facts
=> risky

Pattern produces mostly known facts
=> safe

>Problems

Simple word match is not enough

Coyote invents a wonderful machine.



+

“X invents a Y”

=

invents(Coyote,wonderful)

>Problems

Patterns may be too specific

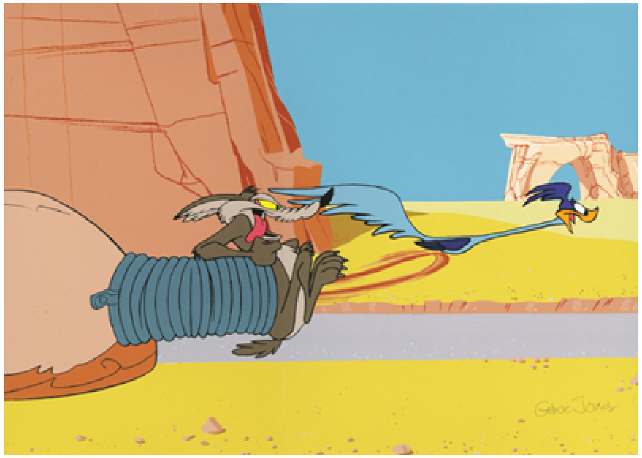
Coyote invents a wonderful machine.

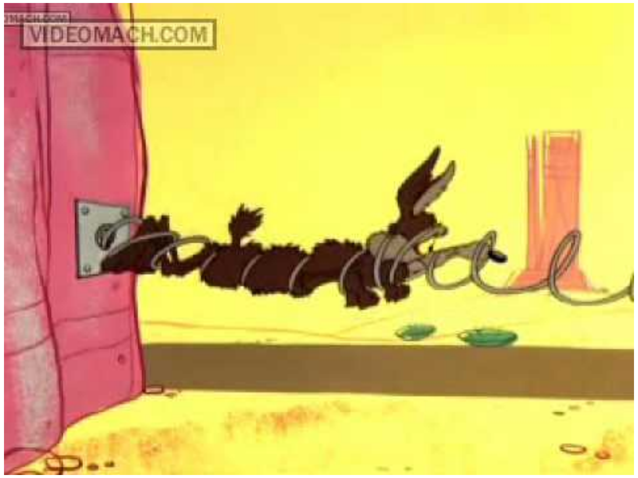
+

“X invents a gorgeous Y”

=

~~invents(Coyote,machine)~~





References

Brin: Extracting Patterns and Relations from the WWW

Agichtein: Snowball

->ie-by-reasoning

->pos-tagging