

Temporal Role Annotation and Disambiguation with the help of DBpedia

Maria Koutraki

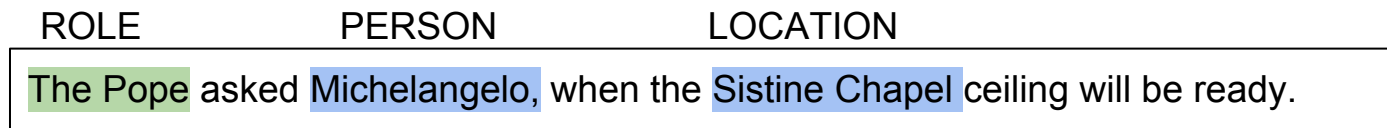
12th DBpedia Community Meeting, Vienna 10.9.2018

What is a role?

“the position or purpose that someone or something has in a situation, organization, society, or relationship”¹

- A role is a position
- Anything (in particular *named entities*) can take over a role

A role is not a named entity, refers to a named entity!



Refers to



Julius II

¹ Cambridge dictionary

What is a role?

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ROLE

PERSON

LOCATION

The Pope asked Michelangelo, when the Sistine Chapel ceiling will be ready.

Categories:

- Permanent roles (e.g. human, mother, ...)
- **Temporal restricted roles** (e.g. CEO of a company, Pope, ...)

¹ Cambridge dictionary

Why (Temporal) Roles?

Behind the Pope's Embrace of Castro

The warmth and hospitality that Pope Francis showed to Raúl Castro at the Vatican last week has built a many-to-many bridge for good between the dictator and the pontiff, religiously.

During their encounter, Castro showed the faith with a quip about returning to the church if the pope favored. He also mocked every Cuban refugee, and or, by giving the pope, of all things, a piece of art, a picture of a man, a portrait of a man.

Pope Francis gave the dictator a copy of his 2013 apostolic exhortation titled "The Joy of the Gospel" in which he decries economic freedom. Talk about preaching to the converted. As Raúl put it, "The pontiff is a Jesuit, and I, in some way, am too. I studied at Jesuit schools."

It's always possible that Pope Francis is hoping to get closer to the regime in order to change it. Maybe he has in mind a spiritual version of a Trojan horse, that once inside the gates of Cuban hell will unleash a stamp of mercy.

With God all things are possible. But I suspect that the papal rapprochement with Castro has more mundane roots.

The Holy Father is a native of 20th-century Argentina, ideologically defined by nationalism, socialism, corporatism and anti-Americanism. It wouldn't be surprising to learn that the pope and the island 90 miles from its shores have much in common.

When the Cuban dictatorship lost its Soviet sugar crutch in the early 1990s, it nearly crumbled. Last year deep economic troubles again looked as if they might force change. As Venezuela, oil substitute to Havana showed, the regime's system featured on the edge of collapse.

It was an opportunity for the church to show solidarity with the impoverished Cuban people, and to show the world that the Vatican stepped in to help the Castro. In February we learned that Pope Francis brooked the Obama Castro thaw, which adds unlikely to spur improvements in human rights, is already generating new interest in investment with the military government.

Some Catholics have tried to witness the pope's hostility toward economic freedom in "The Joy of the Gospel" by arguing that the pope is in a certain sense a socialist, and probably a socialist for a socialist system. This is incorrect. Argentine statistician explicitly documents market economics.

There is another more plausible explanation for why the pope shows disdain to his detractors. For "a crisis and major trust in the goodness of those including economic power and in the paralyzed workings of the existing economic system." It isn't in an Argentine sense of cultural superiority over the money-grubbing capitalists in the north and fear in the state to protect it.

Michael Harkin, the New York Times, traces this to an intellectual battle against the 1920s after the Spanish defeat in the Spanish American war. Reagan, he cites in his 2011 book "Reaganism" inside the Reaganism.

Speculation runs from a Trojan horse plan to Latin American antipathy of the U.S.

After the ban was lifted, Father DiStefano rushed to denounce the late beloved Polish pontiff for "an abuse of authority." He also declared Fidel Castro a messenger of the Holy Spirit in "the necessity of strength" to establish "the reign of God on this earth, that is the alternative to the empire."

Last week, Ben Crutcher, a conservative, the Peruvian who founded the Peruvian Jobs Initiative, the magazine. He told journalists that the church power condemned his brand of thinking of late priested Pope Francis' views on poverty. He didn't mention the pope's views on Peruvian poverty since policy makers the goodness of those including economic power and in the paralyzed workings of the existing economic system.

Fidel forward 115 years and Cuba is again a symbol of struggle between the North, and the South. Many Latin American intellectuals don't like the dictatorship, but they love the U.S. attitude and power. They know that a full-blown collapse of Cuba would threaten the lives of 300 million Americans. That's why they tolerate the status quo.

I can only speculate about the Holy Father's Cuba views. But he is gaining a substantial political reputation. In August 2014, he lifted the church's 50-year ban on Mariposa priest Manuel de Jesús Brockmann's right to celebrate Mass. The controversial cleric, who once served as Argentina's foreign minister for the Marxist dictator, was denounced by Pope John Paul II for refusing to get out of office.

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The Evening Star.

U. S. AT WAR WITH GERMANY; PRESIDENT SIGNS RESOLUTION

EXECUTIVE IN PROCLAMATION CALLS ON ALL CITIZENS AND OFFICERS TO SUPPORT NATION

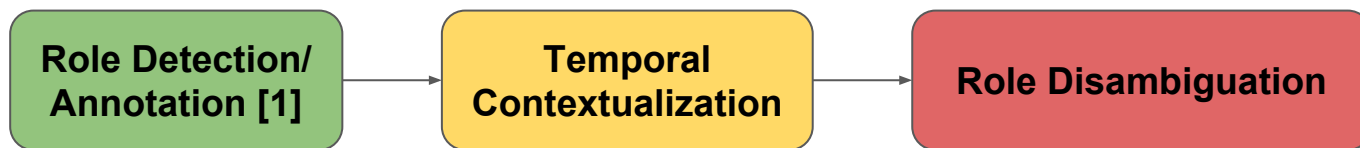
GERMANY ENVOY PRESIDENT'S SPEECH

GERMANY PLEDGES WALL'S PORTS ARE OPEN

PRESIDENT PROCLAIMS WAR BETWEEN U.S. AND GERMANY CALLING CITIZENS TO COLORS



How to deal with Temporal Roles in text?



[1] M. Koutraki, F. Bakhshandegan-Moghaddam, H. Sack, Temporal Role Annotation for Named Entities, SEMANTiCS 2018 (Session 5.2)

Temporal Contextualization and Disambiguation using KGs

*“Leibniz wrote to the **Master of the Mint** about Bernoulli’s book *Ars Conjectandi*.”*

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“Leibniz wrote to the Master of the Mint about Bernoulli’s book Ars Conjectandi.”

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dbo:birthDate

01.07.1646

dbo:deathDate

14.11.1716



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[position held]



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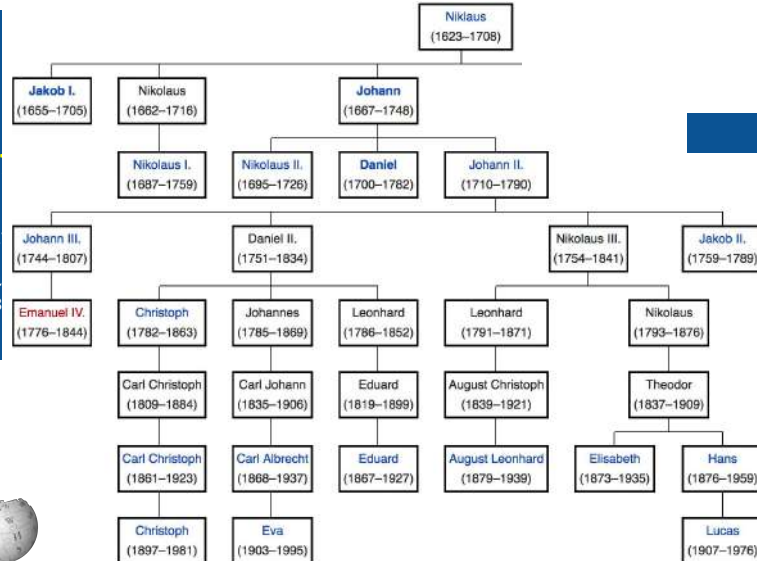
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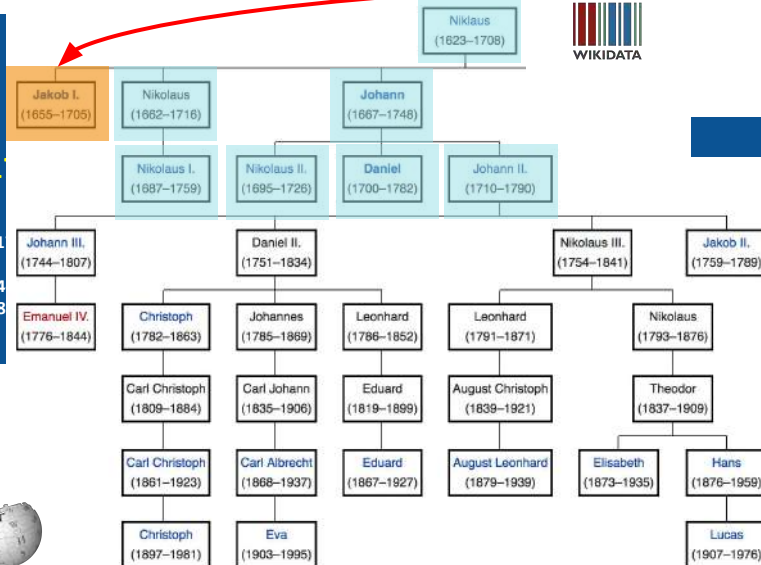
WIKIPEDIA
 The Free Encyclopedia

wdt:P50 [author]

dbr:Ars_Conjectandi

dbp:annee

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Leibniz-Inst

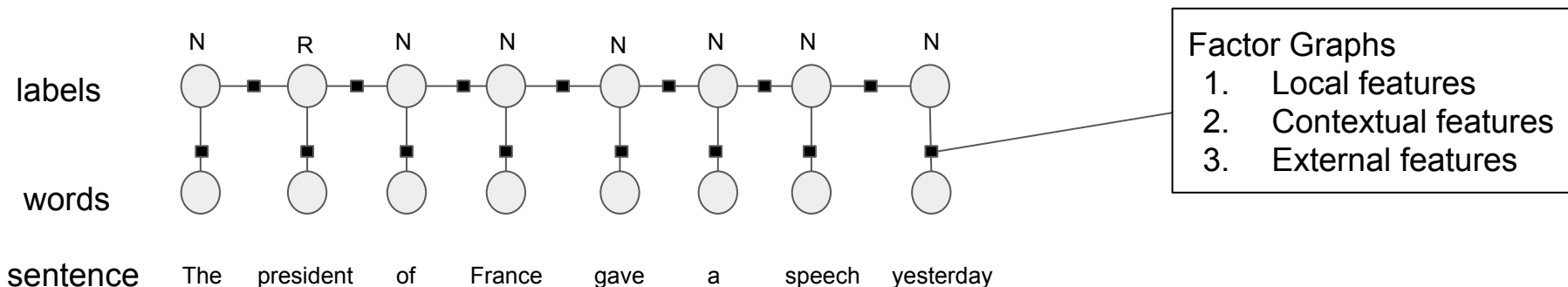
Temporal Role Annotation

Goal: Detect and annotate in an automatic way

- temporal roles and
- role phrases in natural language text

Approach - Head Role Annotator

- Automated approach → sequence classification
 - The roles are influenced by the preceding and succeeding words in a sentence
 - The relation between different words in a sentence has impact in categorization
- Linear-chain CRF model:



Experimental Setup

- Tested Roles:
 - President, Pope, Monarch, CEO
- Ground Truth:
 - Manually created dataset
 - New York Times corpus
 - 200 sentences
 - 64% True Positive 36% False Positive
 - Automatically generated dataset
 - Wikipedia articles

Sample	#tokens
True Positive	6M
False Positive	1.5M
True Negative	3.3M

Evaluation - Performance

- 5-fold cross validation over the automatically extracted dataset

Method	P	R	F ₁
Temp Role Dictionary	0.82	1	0.9
CRF-based Role Annotator	0.94	0.97	0.95

- The dictionary filters out the easy negative samples but not the samples with ambiguous surface forms which may refer to a person name or a role (e.g. Pope)

Conclusion - Temporal Roles for KGs?

- Roles for entities in knowledge graphs are present for most entity types
- Roles represent pivotal information for an entity
- Roles are in abundance in unstructured textual resources
- Roles are highly sparse in existing KGs

Thank You!

Code and Data: <https://github.com/ISE-AIFB/RoleTagger>

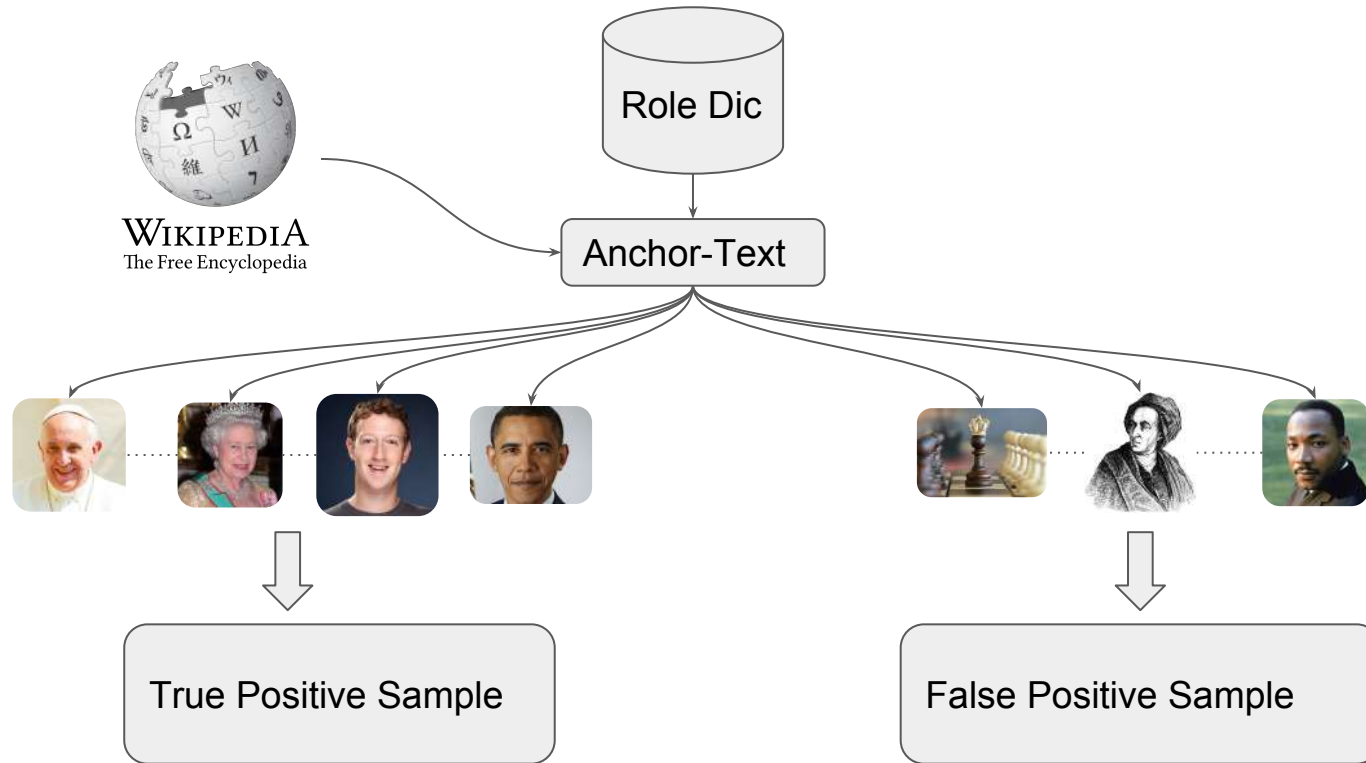
Homepage: <https://www.fiz-karlsruhe.de/en/forschung/information-service-engineering/staff-ise/dr-maria-koutraki.html>

Email: maria.koutraki@fiz-karlsruhe.de, maria.koutraki@kit.edu

Twitter account: [@mairyl0u](https://twitter.com/mairyl0u)



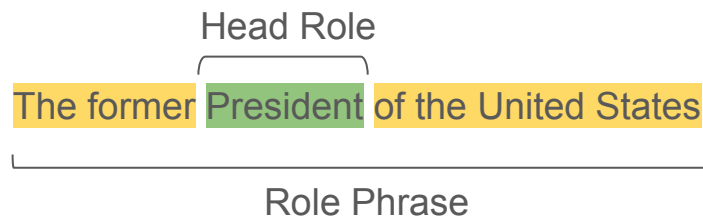
Automatically generated GT Creation



Problem Definition - What is a temporal role?

- Roles that specify one or a few particular entities at a specific point in time
- A function which for a given a *temporal context* returns a *named entity* (or a few)!

- **Head Role:** Identifies the most general variant of a role with potentially high ambiguity
- **Role Phrase:** Specifies the role with sufficient details for the successful disambiguation.



Related Work

- NER
 - NER approaches are optimized to label surface forms that link to a NE class (PERSON, ORGANIZATION, PLACE...)
- NED/EL
 -
- Dictionaries and Gazetteers [1]
 - Domain dependent
 - Manual effort
 - Do not scale
 - Suffer in terms of recall

[1] Cunningham, H., Maynard, D., Bontcheva, K., Tablan, V., 2002. GATE: A Framework and Graphical Development Environment for Robust NLP Tools and Applications. ACL'02

Approach - Local Features

Take into account only the information from the individual words

id	Feature
f_1	w_i
f_2	$\text{POS}(w_i)$
f_3	$\text{NER}(w_i)$
f_4	$\text{startWithCapital}(w_i)$
f_5	$\text{fullyInCapital}(w_i)$
f_6	$\text{startOfSentence}(w_i)$
f_7	$\text{Lemma}(w_i)$

Example: *The president of France gave a speech yesterday*

Feature Values for $i=1$:

f_1 ="The", f_2 ="DT", f_3 ="null", f_4 ="true", f_5 ="false", f_6 ="true", f_7 ="the"

Feature Values for $i=2$:

f_1 ="president", f_2 ="noun", f_3 ="null", f_4 ="false", f_5 ="false", f_6 ="false", f_7 ="president"

Approach - Contextual Features

Capture the dependencies of a word w_i and its surrounding words $w_{i+2} \dots w_{i-2}$

id	Feature
f_{8-11}	$w_{i-2}, w_{i-1}, w_{i+1}, w_{i+2}$
f_{12-15}	$\text{POS}(w_{i-2}), \text{POS}(w_{i-1}),$ $\text{POS}(w_{i+1}), \text{POS}(w_{i+2})$
f_{16-19}	$\text{NER}(w_{i-2}), \text{NER}(w_{i-1}),$ $\text{NER}(w_{i+1}), \text{NER}(w_{i+2})$

Example: *The king in chess is the most important piece*

Feature Values for $i=2$:

$f_8 = \text{"null"}$, $f_9 = \text{"The"}$, $f_{10} = \text{"in"}$, $f_{11} = \text{"chess"}$

Approach - Contextual Features

Capture the dependencies of a word w_i and its surrounding words $w_{i+2} \dots w_{i-2}$

id	Feature
f_{8-11}	$w_{i-2}, w_{i-1}, w_{i+1}, w_{i+2}$
f_{12-15}	$POS(w_{i-2}), POS(w_{i-1}),$ $POS(w_{i+1}), POS(w_{i+2})$
f_{16-19}	$NER(w_{i-2}), NER(w_{i-1}),$ $NER(w_{i+1}), NER(w_{i+2})$

Exploit the commonalities in the language structure!

Example: *The president of France gave a speech yesterday*

Feature Values for $i=2$:

$f_{12} = \text{"null"}$, $f_{13} = \text{"DT"}$, $f_{14} = \text{"IN"}$, $f_{15} = \text{"NNP"}$

Approach - External Features

Use knowledge from external sources

id	Feature
f_{20}	$\text{isInDic}(w_i)$
f_{21}	$\text{LocalGrammar}(w_i)$

- Boolean flag indicating if a token matches to a local grammar

Local Grammar	Samples
ROLE IN (POS) LOCATION (NER)	President of Iran, King of Egypt
ROLE PERSON (NER)	President Obama, Pope Francis
DT (POS) ROLE	The King, The Pope
ROLE IN (POS) ORGANIZATION (NER)	CEO of Apple
ORGANIZATION (NER) ROLE	Google CEO

Approach - External Features

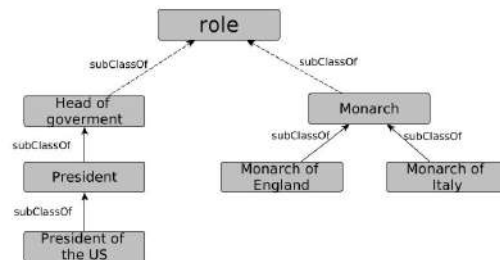
Use knowledge from external sources

id	Feature
f_{20}	$\text{isInDic}(w_i)$
f_{21}	$\text{LocalGrammar}(w_i)$

Boolean flag indicating if a token is part of a dictionary

Approach - External Features - Dictionary

- No existing dictionary dedicated to temporal roles
- Automatically construct a dictionary using knowledge graphs (Wikidata)
- Wikidata class *role*(Q214339) subtree:



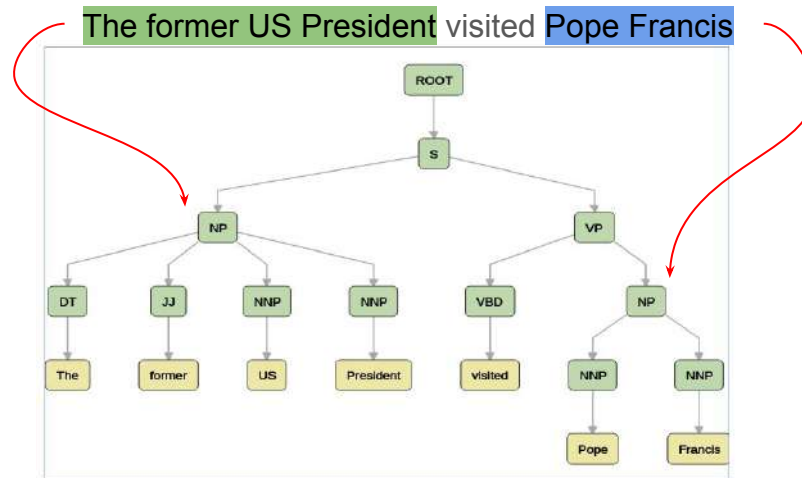
- To ensure the temporal aspect of roles consider time-dependent properties (e.g. “*replaces*”, “*replaced by*”)

query:

```
SELECT DISTINCT ?role ?roleLabel WHERE {  
  ?role instanceOf*|subClassOf* wd:Q214339 .  
  ?role label ?roleLabel.  
  ?person positionHeld ?roleStatement.  
  ?roleStatement positionHeld ?role.  
  ?roleStatement replaces|replacedby ?differentRoleHolder.  
}
```

Approach - Role Phrase Annotation

- Constituency Parse Tree
- Select nearest to the root Noun-Phrase



Evaluation - Robustness

- Trained on the automatically extracted dataset (wikipedia) tested on the manually created dataset (New York Times)

Method	P	R	F ₁
Temp Role Dictionary	0.66	1	0.79
ANNIE Gazetteer	0.55	0.72	0.62
CRF-based Role Annotator	0.80	0.93	0.86

- Dictionary: Cannot differentiate the “Alexander Pope” and “Pope Francis”
- Role Annotator: learns patterns like “<PERSON> Pope” → Not a Role

Evaluation - Feature Ablation

- 5-fold cross validation over the automatically extracted dataset (Wikipedia)

Feature Group	P	R	F ₁
Local Features	0.90	0.95	0.92
Contextual Features	0.72	0.27	0.39
External Features	0.82	1	0.90
All Features	0.94	0.97	0.95
All Features (25% Dictionary size reduction)	0.94	0.92	0.93

Conclusion and Future Steps

- Definition of the task of temporal role annotation
- Proposed a structured prediction approach for the annotation of temporal roles
- Constructed two high quality ground-truth datasets for this task

- Next Steps
 - Experiment with more Role categories
 - Enrich the ground truth
 - Experiment with more features
 - Continue with the subsequent step of disambiguating the temporal roles to the corresponding named entities