

Fine-Grained Evaluation for Entity Linking

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Nov 5, 2019

[†] EMNLP-IJCNLP 2019, Hong Kong

Example

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview with Martin Bashir for the 2003 documentary *Living with Michael Jackson*, Jackson recalled that Joe often sat in a chair with a belt in his hand as he and his siblings rehearsed.

Example - Entity Recognition

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview with Martin Bashir for the 2003 documentary Living with Michael Jackson, Jackson recalled that Joe often sat in a chair with a belt in his hand as he and his siblings rehearsed.

Example - Entity Disambiguation



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Martin Bashir

From Wikipedia, the free encyclopedia

For the former HGTV doc, see [Martin Bashir \(TV series\)](#).

Martin Henry Bashir (born 19 January 1953) is a British journalist.

After initially gaining prominence on British television with his BBC interview with Osama bin Laden, Prince of Wales, and then his controversial *11-9* film documentary with his onetime girlfriend Michael Jackson on TV, Bashir was a political correspondent for MSNBC, hosting *Martin Bashir's 11-9* on MSNBC.



Martin Bashir

[illegible]

The screenshot shows a web browser window. The top navigation bar includes a search icon, a globe icon, and links for 'Log in', 'Talk', 'Contributions', 'Create account', and 'Log out'. The address bar shows 'http://en.wikipedia.org/wiki/United_States_Steel_Corporation'. The main content area displays the Wikipedia article for 'U.S. Steel', which is a free encyclopedia about the United States Steel Corporation. The article text includes: 'The United States Steel Corporation (NYSE: X) is more commonly known as U.S. Steel, is an American integrated steel producer headquartered in Pittsburgh, Pennsylvania, with production operations in the United States, Canada, and Central Europe. As of 2010, the company was the world's 24th largest steel producer and second largest domestic'. The right sidebar shows the 'United States Steel Corporation' logo and a large 'Uss' logo. The bottom of the page has a table with columns for 'Type', 'Theater', 'Music', and 'Industry', with rows for 'Steel' and 'Steel'.

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview with Martin Bashir for the 2003 documentary Living with Michael Jackson, Jackson recalled that Joe often sat in a chair with a belt in his hand as he and his siblings rehearsed.

[illegible]



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Living with Michael Jackson

From Wikipedia, the free encyclopedia

Living with Michael Jackson is a television documentary, in which Martin Bashir interviewed Michael Jackson about a span of 6 months, from May 2003 to January 2005, about different aspects of his life. It was shown first in the United Kingdom on February 3, 2003, and in the United States 3 days later on ABC, introduced by Bashir.



Genre

Documentary

Knowledge Bases



Name Variations in Entity Linking

Michael Joseph Jackson

Michael J. Jackson

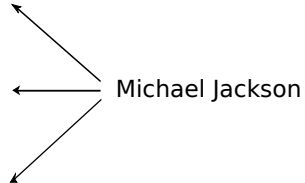
King of Pop




Name Variations in Entity Linking

The image displays three screenshots of Wikipedia articles, each for a different aspect of Michael Jackson's life, demonstrating how the same entity is linked to different names or titles.


- Top Screenshot: Michael Jackson (singer/dancer)**
 - Article title: Michael Jackson
 - From Wikipedia, the free encyclopedia
 - For other people named Michael Jackson, see Michael Jackson (disambiguation).
 - King of Pop
 - Michael Joseph Jackson (August 29, 1958 – June 25, 2009) was an American singer, songwriter, and dancer.
- Middle Screenshot: Michael Jackson (writer)**
 - Article title: Michael Jackson (writer)
 - From Wikipedia, the free encyclopedia
 - For other people named Michael Jackson, see Michael Jackson (disambiguation).
 - Michael Newer Jackson (27 March 1942 – 10 August 2007) was an English writer and journalist. He was the author of many influential books about love and whisky. He was a regular contributor to a number of British newspapers, particularly *The Independent* and *The Observer*.^[1]
- Bottom Screenshot: Michael Jackson (actor)**
 - Article title: Michael Jackson (actor)
 - From Wikipedia, the free encyclopedia
 - For other people named Michael Jackson, see Michael Jackson (disambiguation).
 - This biography of a living person **needs additional citations for verification**. Please help by adding reliable sources. Contentious material about living persons that is unsourced or poorly sourced **must be removed immediately**, especially if potentially libelous or harmful. (May 2024) (Learn how and when to remove this template message)
 - Michael Jackson (born November 8, 1970) is a Canadian actor, grip, guitar and for his acting role as "Trevor" in the comedy TV series *Traitor: Punk Boys* (2005–2017) and the later film *Traitor: Punk Boys: The Movie* (2006).^[1]



Text collections with noise




Donald J. Trump ✓
@realDonaldTrump

 Follow

▼

Despite the constant negative press covfefe


RETWEETS	LIKES
3,263	4,134



2:06 PM - 31 May 2017

 3.2K

 3.3K

 4.1K



Text collections with noise



Donald J. Trump ✓
@realDonaldTrump

 Follow

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RETWEETS
3,263

LIKES
4,134



2:06 PM - 31 May 2017

 3.2K

 3.3K

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Text collections with noise

**Donald J. Trump** 
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Despite the constant negative press covfefe



RETWEETS
3,263


LIKES
4,134



2:06 PM - 31 May 2017

 3.2K  3.3K  4.1K 

**Donald J. Trump** 
@realDonaldTrump



Who can figure out the true meaning of "covfefe" ???
Enjoy!

[Traducir Tweet](#)

6:09 a. m. · 31 may. 2017 · [Twitter for iPhone](#)

Multilingual Entity Linking - English

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Martin Bashir

From Wikipedia, the free encyclopedia

For the former MSNBC show, see *Martin Bashir* (TV series).

Martin Henry Bashir (born 18 January 1960) is a British journalist.

After initially gaining prominence on British television with his BBC interview with Osama bin Laden, Bashir, and then his controversial fly-on-the-wall documentary with pop singer Michael Jackson on ITV, Bashir was a political commentator for MSNBC, hosting *Martin Bashir 360* and *Conversations*.

Martin Bashir

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Joe Jackson (manager)

From Wikipedia, the free encyclopedia

Joseph Walter Jackson (born July 26, 1930) is an American talent manager, and is the patriarch of the Jackson family of entertainers which includes the pop stars Michael Jackson and Janet Jackson.

Joe Jackson

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U.S. Steel

From Wikipedia, the free encyclopedia
(redirected from *USS Steel*)

The **United States Steel Corporation** (NYSE: *USS*), more commonly known as **U.S. Steel**, is an American integrated steel producer headquartered in Pittsburgh, Pennsylvania, with production operations in the United States, Canada, and Central Europe. As of 2016, the company was the world's 24th largest steel producer and second largest domestic.

United States Steel Corporation

USS

Type
Traded as
Industry

Public
NYSE: *USS*
S&P 400 Component
Steel

Joseph Walter "Joe" Jackson, was a steelworker at U.S. Steel. In an interview with Martin Bashir for the 2003 documentary *Living with Michael Jackson*, Jackson recalled that Joe often sat in a chair with a belt in his hand as he and his siblings rehearsed.

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Michael Jackson

From Wikipedia, the free encyclopedia

For other people named Michael Jackson, see *Michael Jackson (disambiguation)*.

"King of Pop" redirects here. For other uses, see *King of Pop (disambiguation)*.

Michael Joseph Jackson (August 29, 1958 – June 25, 2009) was an American singer, songwriter, and dancer. Dubbed the "King of Pop", he was one of the most popular entertainers in the world, and was the best-selling music artist during the year of his death (19). Jackson's contributions to music, dance, and fashion (17) along with his publicized personal life made him a global figure in popular culture for most four decades.

The single child of the Jackson family, Michael made his professional debut in 1964 with his older brothers Jackie, Tito, Jermaine, and Marlon as a member of the Jackson 5. He began his solo career in 1971 with the *Moonwalk* Records, in the early 1980s, Jackson became a billion-dollar figure in popular music, his music videos,

Michael Jackson

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Living with Michael Jackson

From Wikipedia, the free encyclopedia

Living with Michael Jackson is a television documentary, in which Martin Bashir interviewed Michael Jackson over a span of 8 months, from May 2002 to January 2003, about different aspects of his life. It was shown first in the United Kingdom on ITV (as a *Tonight special*) on February 3, 2003, and in the United States 3 days later on ABC, introduced by Bashir.

Living with Michael Jackson

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Multilingual Entity Linking - Italian

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Martin Henry Bashir (born 18 January 1960) is a British journalist.

After initially gaining prominence on British television with his BBC interview with Clive, Prince of Wales, and then his controversial fly-on-the-wall documentary with pop singer Michael Jackson on ITV, Bashir was a political commentator for MSNBC, hosting *Martin Bashir 360* in conversation.

Martin Bashir

(Self-portrait, 2003)

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Joe Jackson (manager)

From Wikipedia, the free encyclopedia

Joseph Walter Jackson (born July 26, 1930) is an American talent manager, and is the patriarch of the Jackson family of entertainers which includes the pop stars Michael Jackson and Janet Jackson.

Contents [show]

Early life and ancestry

Jackson was born to Samuel Jackson (1880–1983), an university professor, and Crystal Lee King (1903–1987). In February 198, his parents, on July 26, 1930, born in 1930, according to the Adams Family Hall of Fame and Jacksons look they marry, the Jacksons' father was the oldest of five children, which included brother Lawrence (died 1970) and father and sister Lela Mae and her son Sam. Sam was the son of Isaac and Jackson (1903–1987). Jackson's father was the son of Isaac and Jackson (1903–1987).

Joe Jackson

(Self-portrait, 2003)

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U.S. Steel

From Wikipedia, the free encyclopedia (redirected from USS Steel)

The United States Steel Corporation (NYSE: **U.S.S.**), more commonly known as **U.S. Steel**, is an American integrated steel producer headquartered in Pittsburgh, Pennsylvania, with production operations in the United States, Canada, and Central Europe. As of 2015, the company was the world's 24th largest steel producer and second largest domestic.

United States Steel Corporation

USS

Type: Public
Traded as: NYSE: U.S.S.
Industry: Steel

Joseph Walter “Joe” Jackson, era un operaio siderurgico presso U.S. Steel.

In un'intervista con Martin Bashir per il documentario del 2003 Living with Michael Jackson, Jackson ha ricordato che Joe spesso sedeva su una sedia con una cintura in mano mentre lui e i suoi fratelli provavano.

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Michael Jackson

From Wikipedia, the free encyclopedia

For other people named Michael Jackson, see **Michael Jackson (disambiguation)**.

*"King of Pop" redirects here. For other uses, see **King of Pop** (disambiguation).*

Michael Joseph Jackson (August 26, 1958 – June 25, 2009) was an American singer, songwriter, and dancer. Dubbed the "King of Pop", he was one of the most popular entertainers in the world, and was the best-selling music artist during the 20th century.

Jackson's contributions to music, dance, and fashion with MTV, along with his publicized personal life, made him a global figure in popular culture for most of his life.

The single child of the Jackson family, Michael made his professional debut in 1964 with his older brothers Jermaine, Jackie, and Marlon as a member of the Jackson 5. He began his solo career in 1971 with the *Moonwalk* Records. In the early 1980s, Jackson became a global star in popular music. His music videos, such as "Billie Jean" and "Thriller", were influential in the development of the music video industry.

Michael Jackson

(Self-portrait, 2003)

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Living with Michael Jackson

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Living with Michael Jackson is a television documentary, in which Martin Bashir interviewed Michael Jackson over a span of 8 months, from May 2002 to January 2003, about different aspects of his life. It was shown first in the United Kingdom on ITV (as a *Saturday Special*) on February 3, 2003, and in the United States 3 days later on ABC, introduced by Bashir.

Living with Michael Jackson

(Self-portrait, 2003)

Multilingual Entity Linking - Spanish

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United States Steel Corporation

Type Public
Traded as NYSE: *NYSE: USS*
Industry Steel

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Joseph Walter “Joe” Jackson, era un trabajador siderúrgico en U.S. Steel. En una entrevista con Martin Bashir para el documental del 2003 Living with Michael Jackson, Jackson recordó que Joe a menudo se sentaba en una silla con un cinturón en la mano mientras él y sus hermanos ensayaban.

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From Wikipedia, the free encyclopedia

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The eighth child of the Jackson family, Michael made his professional debut in 1964 with his older brothers Jackie, Tito, Jermaine, and Marlon as a member of the Jackson 5. He began his solo career in 1970 with the *Moonwalk* Records, and in the early 1980s, Jackson became a dominant force in popular music. His music videos,

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Living with Michael Jackson

Type Documentary

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- What should Entity Linking link?

Example annotations produced by four EL systems

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview with Martin Bashir for the 2003 documentary Living with Michael Jackson, Jackson recalled that Joe often sat in a chair with a belt in his hand as he and his siblings rehearsed.

Example annotations produced by four EL systems

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview
 $\quad D \quad \quad \quad D|T \quad \quad \quad B|D \quad A|B|T \quad \quad \quad D|T$
with Martin Bashir for the 2003 documentary Living with Michael Jackson,
 $\quad A|D|T \quad \quad \quad D \quad \quad \quad B|T \quad \quad \quad A|B|D$
Jackson recalled that Joe often sat in a chair with a belt in his hand as he and
 $\quad A|B \quad \quad \quad A \quad \quad \quad T \quad \quad \quad D|T \quad \quad \quad T$
his siblings rehearsed.
 $\quad \quad \quad D|T$

Example annotations produced by four EL systems

Aida

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview
 $\quad D \quad \quad \quad D|T \quad \quad \quad \begin{smallmatrix} B|D & A|B|T \end{smallmatrix} \quad \quad \quad D|T$
with Martin Bashir for the 2003 documentary Living with Michael Jackson,
 $\quad \quad \quad A|D|T \quad \quad \quad D \quad \quad \quad B|T \quad \quad \quad \begin{smallmatrix} A|B|D \end{smallmatrix}$
Jackson recalled that Joe often sat in a chair with a belt in his hand as he and
 $\quad \quad \quad A|B \quad \quad \quad A \quad \quad \quad T \quad \quad \quad D|T \quad \quad \quad T$
his siblings rehearsed.
 $\quad \quad \quad D|T$

Example annotations produced by four EL systems

Aida

Babelify

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview
 $\frac{D}{D}$ $\frac{D|T}{D|T}$ $\frac{B|D}{B|D}$ $\frac{A|B|T}{A|B|T}$ $\frac{D|T}{D|T}$
with Martin Bashir for the 2003 documentary Living with Michael Jackson,
 $\frac{A|D|T}{A|D|T}$ $\frac{D}{D}$ $\frac{B|T}{B|T}$ $\frac{A|B|D}{A|B|D}$
Jackson recalled that Joe often sat in a chair with a belt in his hand as he and
 $\frac{A|B}{A|B}$ $\frac{A}{A}$ $\frac{T}{T}$ $\frac{D|T}{D|T}$ $\frac{T}{T}$
his siblings rehearsed.
 $\frac{D|T}{D|T}$

Example annotations produced by four EL systems

Aida

Babelify

DBpedia Spotlight

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview with Martin Bashir for the 2003 documentary Living with Michael Jackson, Jackson recalled that Joe often sat in a chair with a belt in his hand as he and his siblings rehearsed.

Example annotations produced by four EL systems

Aida

Babelify

DBpedia Spotlight

TagME

Joseph Walter “Joe” Jackson, was a steelworker at U.S. Steel. In an interview
with Martin Bashir for the 2003 documentary Living with Michael Jackson,
Jackson recalled that Joe often sat in a chair with a belt in his hand as he and
his siblings rehearsed.

Questionnaire

Gong-Qing Wu, Ying He, and Xuegang Hu. 2018. Entity linking: An issue to extract corresponding entity with knowledge base. IEEE Access, 6:62206231.

Questionnaire

In an interview with Martin Bashir for the 2003 documentary Living with Michael Jackson, the King of Pop recalled that Joe often sat with a white belt at hand as he and his four siblings rehearsed.

Russian daily Kommersant reports that Moscow will supply the Greeks with gas at rock bottom prices as Tsipras prepares to meet the Russian President.

Questionnaire

[[Russian]] daily Kommersant reports that ...

- ☐ Annotate "Russian" with <https://en.wikipedia.org/wiki/Russia> <tick all that apply>
- ☐ Annotate "Russian" with https://en.wikipedia.org/wiki/Russian_language <tick all that apply>
- ☐ Annotate "Russian" with <https://en.wikipedia.org/wiki/Russians> <tick all that apply>
- ☐ Do not annotate "Russian"

Russian [[daily]] Kommersant reports that ...

- ☐ Annotate "daily" with <https://en.wikipedia.org/wiki/Newspaper>
- ☐ Do not annotate "daily"

Questionnaire

- ① We sent the questionnaire to 321 researchers, of which 232 requests were delivered successfully.
- ② We received a total of 36 responses.

Questionnaire

In an [interview].¹⁹ with [Martin Bashir].¹ for the [2003].²⁸ [documentary].²⁸ [Living with {Michael Jackson}.⁷⁵].⁹⁷, the [{King}.⁰⁸ of {Pop}.³³].⁹⁴ [recalled].⁰⁶ that [Joe].¹ often [sat].⁰⁸ with a [white].¹¹ [belt].¹⁴ at [hand].¹⁴ as [{he}.⁵⁶ and {his}.³⁹ {four}.⁰⁸ {siblings}.¹⁴].⁵⁰ [rehearsed].⁰⁸.

[Russian].⁶¹ [daily].¹⁴ [Kommersant].⁹⁷ [reports].⁰⁶ that [Moscow].⁹⁴ will [supply].⁰⁶ the [Greeks].⁹⁴ with [gas].³⁶ at [{rock}.⁰ bottom {prices}.¹⁹].²⁸ as [Tsipras].⁹² [prepares].⁰³ to [meet].⁰⁶ the [{Russian}.⁵³ {President}.¹²].⁹⁷.

Questionnaire

In an [interview].¹⁹ with [Martin Bashir].¹ for the [2003].²⁸ [documentary].²⁸ [Living with {Michael Jackson}.⁷⁵].⁹⁷, the [{King}.⁰⁸ of {Pop}.³³].⁹⁴ [recalled].⁰⁶ that [Joe].¹ often [sat].⁰⁸ with a [white].¹¹ [belt].¹⁴ at [hand].¹⁴ as [{he}.⁵⁶ and {his}.³⁹ {four}.⁰⁸ {siblings}.¹⁴].⁵⁰ [rehearsed].⁰⁸.

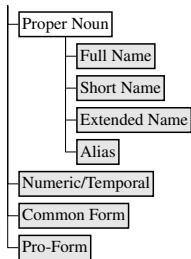
[Russian].⁶¹ [daily].¹⁴ [Kommersant].⁹⁷ [reports].⁰⁶ that [Moscow].⁹⁴ will [supply].⁰⁶ the [Greeks].⁹⁴ with [gas].³⁶ at [{rock}.⁰ bottom {prices}.¹⁹].²⁸ as [Tsipras].⁹² [prepares].⁰³ to [meet].⁰⁶ the [{Russian}.⁵³ {President}.¹²].⁹⁷.

Goal

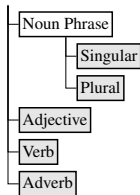
- 1 Allowing a fine-grained evaluation for Entity Linking

Categories

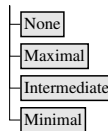
BASE FORM



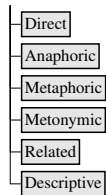
PART OF SPEECH



OVERLAP

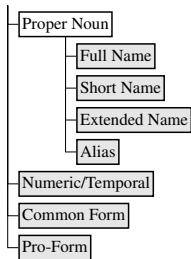


REFERENCE

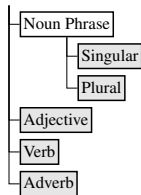


Categories

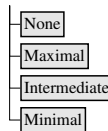
BASE FORM



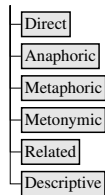
PART OF SPEECH



OVERLAP



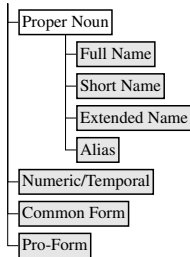
REFERENCE



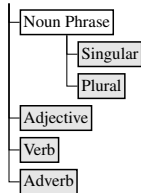
Joseph Walter, was a steelworker at U.S Steel.

Categories

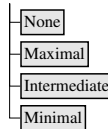
BASE FORM



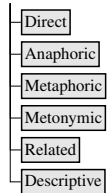
PART OF SPEECH



OVERLAP



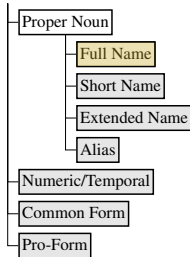
REFERENCE



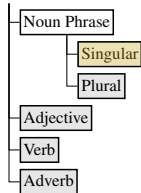
Joseph Walter, was a steelworker at U.S Steel.

Categories

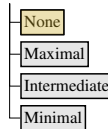
BASE FORM



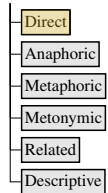
PART OF SPEECH



OVERLAP



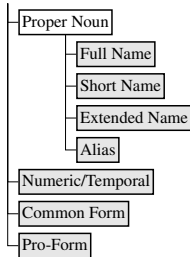
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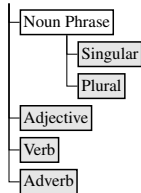
Joseph Walter, was a steelworker at U.S Steel.

Categories

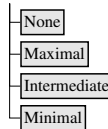
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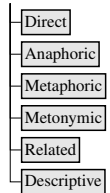
PART OF SPEECH



OVERLAP



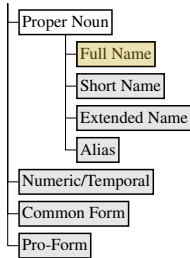
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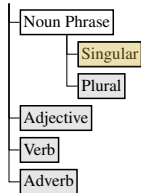
Joseph Walter, was a steelworker at **U.S Steel**.

Categories

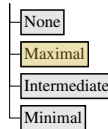
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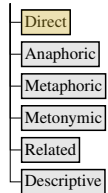
PART OF SPEECH



OVERLAP



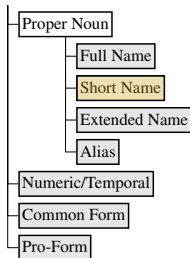
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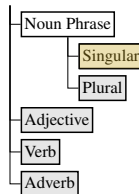
Joseph Walter, was a steelworker at U.S Steel.

Categories

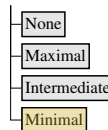
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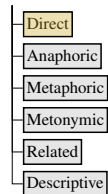
PART OF SPEECH



OVERLAP



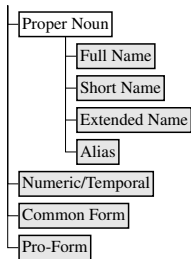
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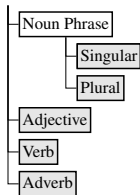
Joseph Walter, was a steelworker at **U.S** Steel.

Categories

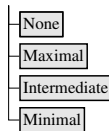
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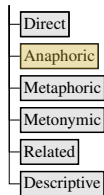
PART OF SPEECH



OVERLAP

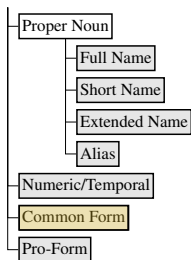


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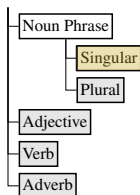


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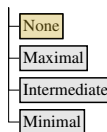
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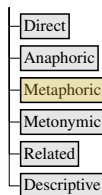
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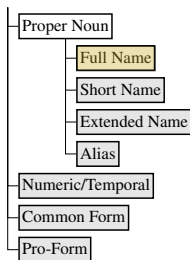
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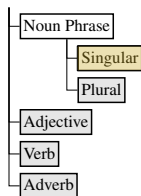
David and Victoria added **spice** to their marriage.

Categories

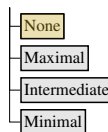
BASE FORM



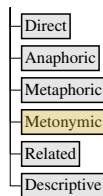
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OVERLAP



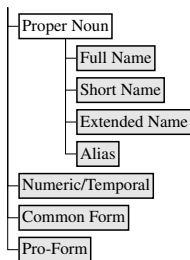
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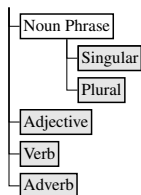
Greece beat England in the Euro Finals.

Categories

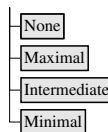
BASE FORM



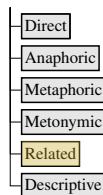
PART OF SPEECH



OVERLAP



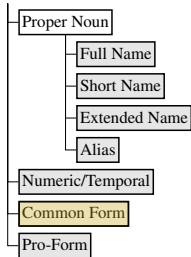
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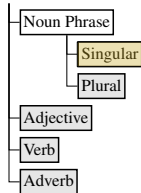
Today I am presenting my Doctoral Proposal
<https://en.wikipedia.org/wiki/Present>

Categories

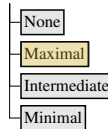
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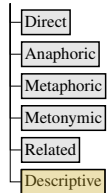
PART OF SPEECH



OVERLAP



REFERENCE



The capital of Chile is an incredible city.

Re-annotation and categorization

- ① KORE50: 1 doc, 50 sentences
- ② VoxEL: 15 doc, 94 sentences
- ③ ACE04: first 20 doc, 214 sentences

Re-annotation and categorization

A  salary  wake-up  call .

With  his clear-cut  positions and  confrontational  attitude towards other  powers , the  thundering  businessman who occupies the   White  House since   January  20th has the merit of  centering the  attention of the  majority of  European  countries .

It's  now  time to transform this  shared  attitude into  real  politics .

For the   European  Union ,  Donald Trump is  nothing less than a  blessing , since, in just a few  phrases , and with remarkable  efficacy ,  he has made  it close ranks more than ever for a long  time .

 Donald Trump belongs to that  category of  Americans who have never liked for the  idea of  a  united  Europe , because they  see  it as a  threat to the  economic  preeminence of  their own  country .

Re-annotation and categorization

Surface Form:

Donald Trump

Add annotation

Link of the selected entity mention

- Select Type - ▾

+ Add

List of URIs:

https://en.wikipedia.org/wiki/Donald_Trump

PERSON ▾

Link

✕ Remove

✕ el:Mnt-Full

✕ el:PoS-NounSingular

✕ el:Ref-Direct

✕ el:Olp-None

Validating by tag

	A	B _s			B _r			T			D			A			F		
		P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁
Full Mention	766	0.93	0.46	0.61	0.75	0.53	0.62	0.82	0.59	0.69	0.84	0.57	0.68	0.78	0.57	0.66	0.82	0.55	0.65
Short Mention	497	0.44	0.16	0.23	0.37	0.24	0.29	0.54	0.44	0.48	0.5	0.3	0.37	0.5	0.36	0.42	0.39	0.28	0.33
Extended Mention	9	1.0	0.56	0.71	0.83	0.56	0.67	1.0	0.44	0.62	1.0	0.44	0.62	1.0	0.44	0.62	0.8	0.44	0.57
Alias	112	0.56	0.16	0.25	0.33	0.21	0.25	0.52	0.32	0.4	0.67	0.38	0.48	0.6	0.29	0.4	0.55	0.29	0.38
Numeric/Temporal	404	0.45	0.01	0.02	0.82	0.24	0.37	0.14	0.03	0.05	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Common Form	2,452	0.21	0.0	0.01	0.66	0.33	0.44	0.49	0.28	0.35	0.88	0.04	0.08	0.43	0.0	0.0	0.56	0.0	0.01
Pro-form	153	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Singular Noun	2,623	0.79	0.17	0.28	0.73	0.45	0.56	0.62	0.38	0.47	0.87	0.24	0.38	0.79	0.2	0.32	0.74	0.19	0.31
Plural Noun	746	0.33	0.01	0.02	0.61	0.33	0.43	0.56	0.28	0.37	0.83	0.03	0.06	0.7	0.03	0.07	0.66	0.04	0.07
Adjective	516	0.77	0.02	0.04	0.26	0.07	0.11	0.56	0.24	0.34	0.65	0.14	0.23	0.72	0.21	0.32	0.6	0.14	0.22
Verb	334	0	0.0	0.0	0.86	0.02	0.04	0.37	0.17	0.23	1.0	0.0	0.01	0	0.0	0.0	0	0.0	0.0
Adverb	12	0	0.0	0.0	0	0.0	0.0	0.56	0.42	0.48	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Non-Overlapping	2,871	0.75	0.12	0.2	0.67	0.33	0.45	0.58	0.38	0.46	0.84	0.19	0.32	0.78	0.19	0.3	0.71	0.17	0.27
Maximal Overlap	464	0.87	0.17	0.29	0.85	0.36	0.5	0.73	0.34	0.46	0.89	0.19	0.32	0.84	0.08	0.15	0.84	0.12	0.22
Intermediate Overlap	71	0.76	0.18	0.3	0.71	0.52	0.6	0.57	0.3	0.39	0.56	0.13	0.21	0.54	0.1	0.17	0.78	0.1	0.17
Minimal Overlap	825	0.82	0.04	0.09	0.61	0.37	0.46	0.5	0.15	0.23	0.8	0.09	0.17	0.72	0.09	0.16	0.66	0.06	0.12
Direct	3,106	0.79	0.13	0.23	0.71	0.43	0.53	0.63	0.38	0.47	0.83	0.21	0.33	0.76	0.19	0.3	0.7	0.17	0.27
Anaphoric	153	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Metaphoric	69	0.0	0.0	0.0	0.57	0.29	0.38	0.43	0.35	0.38	0.91	0.14	0.25	0	0.0	0.0	0	0.0	0.0
Metonymic	73	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Related	829	0.64	0.06	0.11	0.36	0.14	0.2	0.39	0.24	0.3	0.76	0.1	0.18	0.81	0.08	0.15	0.83	0.09	0.16
Descriptive	189	0.33	0.01	0.01	0.44	0.02	0.04	0.16	0.02	0.03	0.6	0.02	0.03	0	0.0	0.0	0.6	0.02	0.03
All	4,231	0.77	0.11	0.19	0.67	0.35	0.46	0.59	0.33	0.42	0.84	0.17	0.29	0.77	0.16	0.26	0.72	0.14	0.24

Validating by tag

	A	B _s			B _r			T			D			A			F		
		P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁
Full Mention	766	0.93	0.46	0.61	0.75	0.53	0.62	0.82	0.59	0.69	0.84	0.57	0.68	0.78	0.57	0.66	0.82	0.55	0.65
Short Mention	497	0.44	0.16	0.23	0.37	0.24	0.29	0.54	0.44	0.48	0.5	0.3	0.37	0.5	0.36	0.42	0.39	0.28	0.33
Extended Mention	9	1.0	0.56	0.71	0.83	0.56	0.67	1.0	0.44	0.62	1.0	0.44	0.62	1.0	0.44	0.62	0.8	0.44	0.57
Alias	112	0.56	0.16	0.25	0.33	0.21	0.25	0.52	0.32	0.4	0.67	0.38	0.48	0.6	0.29	0.4	0.55	0.29	0.38
Numeric/Temporal	404	0.45	0.01	0.02	0.82	0.24	0.37	0.14	0.03	0.05	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Common Form	2,452	0.21	0.0	0.01	0.66	0.33	0.44	0.49	0.28	0.35	0.88	0.04	0.08	0.43	0.0	0.0	0.56	0.0	0.01
Pro-form	153	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Singular Noun	2,623	0.79	0.17	0.28	0.73	0.45	0.56	0.62	0.38	0.47	0.87	0.24	0.38	0.79	0.2	0.32	0.74	0.19	0.31
Plural Noun	746	0.33	0.01	0.02	0.61	0.33	0.43	0.56	0.28	0.37	0.83	0.03	0.06	0.7	0.03	0.07	0.66	0.04	0.07
Adjective	516	0.77	0.02	0.04	0.26	0.07	0.11	0.56	0.24	0.34	0.65	0.14	0.23	0.72	0.21	0.32	0.6	0.14	0.22
Verb	334	0	0.0	0.0	0.86	0.02	0.04	0.37	0.17	0.23	1.0	0.0	0.01	0	0.0	0.0	0	0.0	0.0
Adverb	12	0	0.0	0.0	0	0.0	0.0	0.56	0.42	0.48	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
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Minimal Overlap	825	0.82	0.04	0.09	0.61	0.37	0.46	0.5	0.15	0.23	0.8	0.09	0.17	0.72	0.09	0.16	0.66	0.06	0.12
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Anaphoric	153	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Metaphoric	69	0.0	0.0	0.0	0.57	0.29	0.38	0.43	0.35	0.38	0.91	0.14	0.25	0	0.0	0.0	0	0.0	0.0
Metonymic	73	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Related	829	0.64	0.06	0.11	0.36	0.14	0.2	0.39	0.24	0.3	0.76	0.1	0.18	0.81	0.08	0.15	0.83	0.09	0.16
Descriptive	189	0.33	0.01	0.01	0.44	0.02	0.04	0.16	0.02	0.03	0.6	0.02	0.03	0	0.0	0.0	0.6	0.02	0.03
All	4,231	0.77	0.11	0.19	0.67	0.35	0.46	0.59	0.33	0.42	0.84	0.17	0.29	0.77	0.16	0.26	0.72	0.14	0.24

Validating by tag

	A	B _s			B _r			T			D			A			F		
		P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁	P	R	F ₁
Full Mention	766	0.93	0.46	0.61	0.75	0.53	0.62	0.82	0.59	0.69	0.84	0.57	0.68	0.78	0.57	0.66	0.82	0.55	0.65
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Common Form	2,452	0.21	0.0	0.01	0.66	0.33	0.44	0.49	0.28	0.35	0.88	0.04	0.08	0.43	0.0	0.0	0.56	0.0	0.01
Pro-form	153	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Singular Noun	2,623	0.79	0.17	0.28	0.73	0.45	0.56	0.62	0.38	0.47	0.87	0.24	0.38	0.79	0.2	0.32	0.74	0.19	0.31
Plural Noun	746	0.33	0.01	0.02	0.61	0.33	0.43	0.56	0.28	0.37	0.83	0.03	0.06	0.7	0.03	0.07	0.66	0.04	0.07
Adjective	516	0.77	0.02	0.04	0.26	0.07	0.11	0.56	0.24	0.34	0.65	0.14	0.23	0.72	0.21	0.32	0.6	0.14	0.22
Verb	334	0	0.0	0.0	0.86	0.02	0.04	0.37	0.17	0.23	1.0	0.0	0.01	0	0.0	0.0	0	0.0	0.0
Adverb	12	0	0.0	0.0	0	0.0	0.0	0.56	0.42	0.48	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Non-Overlapping	2,871	0.75	0.12	0.2	0.67	0.33	0.45	0.58	0.38	0.46	0.84	0.19	0.32	0.78	0.19	0.3	0.71	0.17	0.27
Maximal Overlap	464	0.87	0.17	0.29	0.85	0.36	0.5	0.73	0.34	0.46	0.89	0.19	0.32	0.84	0.08	0.15	0.84	0.12	0.22
Intermediate Overlap	71	0.76	0.18	0.3	0.71	0.52	0.6	0.57	0.3	0.39	0.56	0.13	0.21	0.54	0.1	0.17	0.78	0.1	0.17
Minimal Overlap	825	0.82	0.04	0.09	0.61	0.37	0.46	0.5	0.15	0.23	0.8	0.09	0.17	0.72	0.09	0.16	0.66	0.06	0.12
Direct	3,106	0.79	0.13	0.23	0.71	0.43	0.53	0.63	0.38	0.47	0.83	0.21	0.33	0.76	0.19	0.3	0.7	0.17	0.27
Anaphoric	153	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Metaphoric	69	0.0	0.0	0.0	0.57	0.29	0.38	0.43	0.35	0.38	0.91	0.14	0.25	0	0.0	0.0	0	0.0	0.0
Metonymic	73	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Related	829	0.64	0.06	0.11	0.36	0.14	0.2	0.39	0.24	0.3	0.76	0.1	0.18	0.81	0.08	0.15	0.83	0.09	0.16
Descriptive	189	0.33	0.01	0.01	0.44	0.02	0.04	0.16	0.02	0.03	0.6	0.02	0.03	0	0.0	0.0	0.6	0.02	0.03
All	4,231	0.77	0.11	0.19	0.67	0.35	0.46	0.59	0.33	0.42	0.84	0.17	0.29	0.77	0.16	0.26	0.72	0.14	0.24

How to perform an evaluation for categorized datasets?

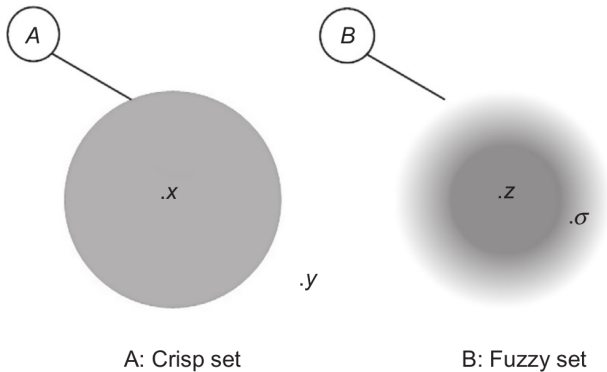
Traditional F1

$$P = \frac{|TP|}{|S|}$$

$$R = \frac{|TP|}{|G|}$$

$$F_1 = \frac{2 \cdot P \cdot R}{P + R}$$

Fuzzy set



Modifications to F1

$$P = \frac{|TP|}{|S|}$$

$$R^* = \frac{\sum_{a \in S} \mu_{G^*}(a)}{\sum_{a \in G} \mu_{G^*}(a)}$$

$$F_1 = \frac{2 \cdot P \cdot R^*}{P + R^*}$$

- **PROP1:** the values for R^* and F_1^* both range between 0 and 1, inclusive.
- **PROP2:** when $\mu_{G^*} : G \rightarrow \{1\}$ (i.e., when memberships are binary), R^* and F_1^* correspond to R and F_1 .
- **PROP3:** missing annotations with higher membership degree are penalized more in R^* and F_1^* than those with lower degree.

Conclusions

- We stress the lack of consensus about what should Entity Linking link.
- We propose a set of categories for Entity Linking.
- We re-annotate three datasets: VoxEL, KORE50 and ACE04—first_20.
- We extend F_1 measure.

Fine-Grained Evaluation for Entity Linking

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[†] EMNLP-IJCNLP 2019, Hong Kong