



**Hasso
Plattner
Institut**

IT Systems Engineering | Universität Potsdam



semex
Semantic Media Explorer

Neue Wege der Suche in Medienarchiven

Dr. Harald Sack

Hasso-Plattner-Institut für Softwaresystemtechnik

Universität Potsdam

3. Leipziger Semantic Web Tag, 5. Mai 2011

HPI

Hasso Plattner Institut



IT Systems Engineering | Universität Potsdam

- Das HPI wurde im Oktober 1998 im Rahmen einer Public-Private-Partnership gegründet
- Forschung und Lehre am HPI ist dem „*IT Systems Engineering*“ gewidmet
- 10 Professoren und ca. 100 Mitarbeiter in Forschung und Lehre
- aktuell 450 Studenten in universitären Studiengängen „*IT Systems Engineering*“
- CHE-Ranking 2010 sieht HPI auf Top-Rang



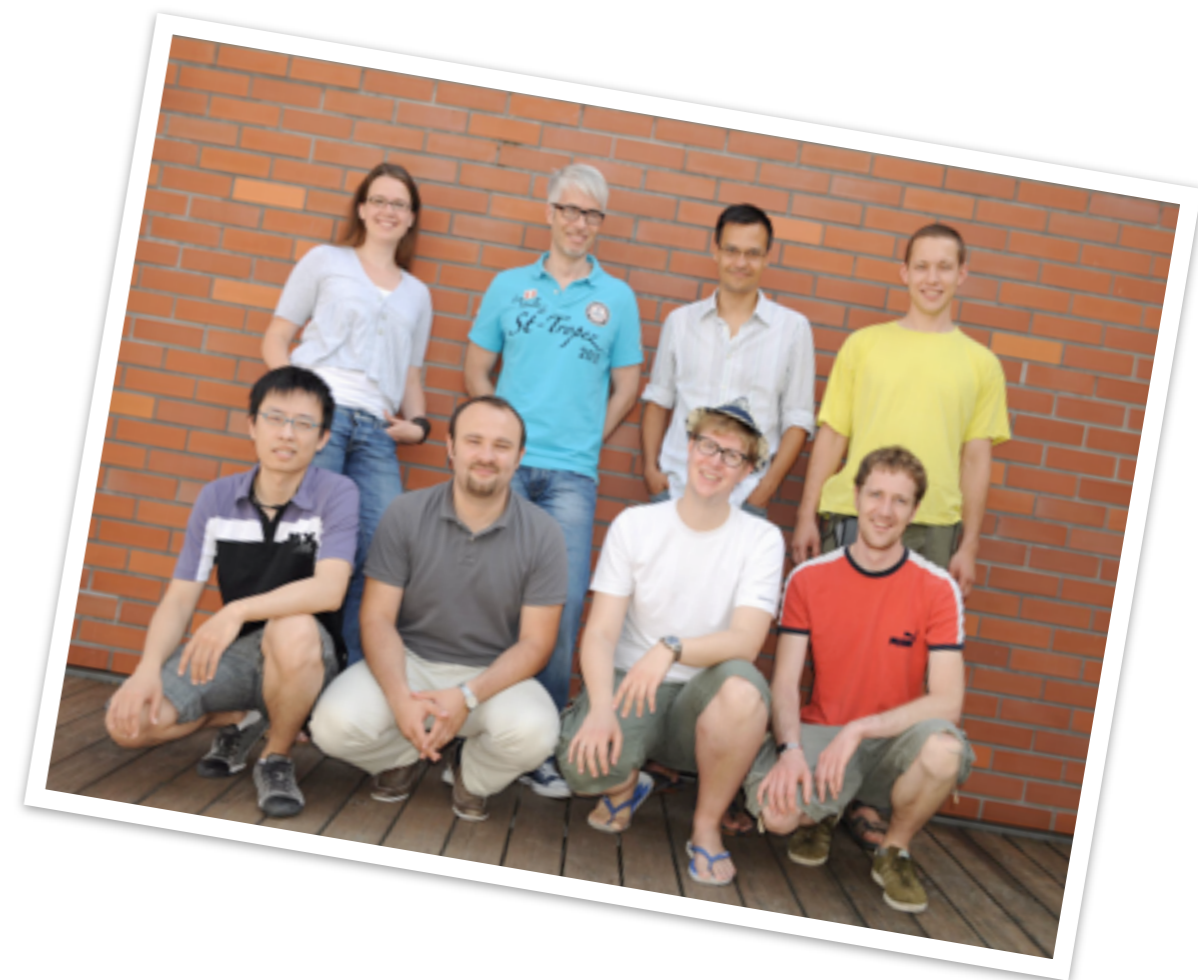
Dr. Harald Sack, 3. Leipziger Semantic Web Tag, 5. Mai 2011

- Forschungsgruppe „*Semantic Technologies & Multimedia Retrieval*“

- Research Topics

- Semantic Web Technologies
- Ontological Engineering
- Information Retrieval
- Multimedia Analysis & Retrieval
- Social Networking
- Data/Information Visualization

- Research Projects



yovistolabs ●



mediaglobe

the digital archive

- **THESEUS** Forschungsprogramm:
Neue internetbasierte Wissensinfrastruktur.
 - **UseCase Contentus:** Technologien für die Mediathek der Zukunft.
 - **Projekt Mediaglobe:**
Effizientes Arbeiten mit Metadaten in Medienarchiven und Rundfunkanstalten.



Bundesministerium
für Wirtschaft
und Technologie



- effiziente Suche nach/in AV-Inhalten in Medienarchiven und Rundfunkanstalten
- Arbeitsprozesslösung für die effiziente Erfassung, Aufbereitung und Verwertung von AV-Inhalten

mediaglobe

the digital archive

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Requirement Analysis and Media Census

Data Collection from >200 AV-Archives about digitization, online distribution, and rights management



Efficient Digitization of AV-Archives

Workflow definition, evaluation, and best practices



Software Enabled Digital Rights Management

Workflow definition, best practices for unique determination of copyrights



Automated AV Media Analysis

Extraction of textual and semantic metadata for semantic search



Metadata Engineering

Definition, interlinking, and validation of (semantic) metadata model for media archives



Semantic Search

Combining semantic metadata into semantic search index to enable high precision/recall retrieval



User Interface Design

Support of innovative search strategies with semantic data/information visualization



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User Interface Design

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Wie kommt Google zu Informationen über ein Video?

Web Images Videos Maps News Shopping Mail more ▾ Lysander07@googlemail.com | V

Google videos [Advanced Search](#)

Web > Videos Hide options Results 1 - 10 of about 12,300 for multimedia [definition]. (0.23 seconds)


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[Past 24 hours](#)
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[Past year](#)
[Specific date range](#)

▶ [Sorted by relevance](#)
[Sorted by date](#)


▶ [Any quality](#)
[High quality](#)




[What is Multimedia?](#) ☆
3 min 23 sec - 24 Apr 2009
Multimedia Technologies at Pittsburgh Technical Institute School of Design, teaches students a variety of skills, including Web design, Flash ...
[youtube.com](#) - [Related videos](#)



[NASA - Space Shuttle Multimedia](#) ☆
25 Nov 2009
NASA.gov brings you images, videos and interactive features from the unique perspective of America's space agency. Get the latest ...
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[Takagi Masakatsu: Multimedia Artist](#) ☆
3 min 25 sec - 12 Apr 2007
An artist trying to make sense of the world, delicately molding the everyday into the sublime. Lifting piano lines, digitally-enhanced melodies ...
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[Dreamweaver: Multimedia](#) ☆
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Wie findet man etwas in einem audiovisuellen Archiv?

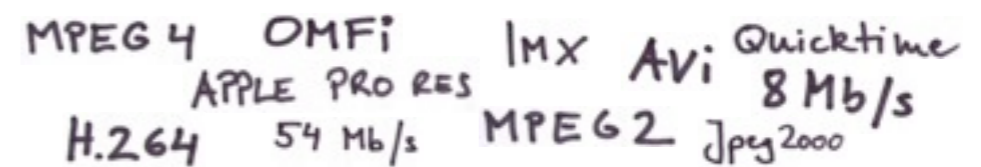


Wie findet man etwas in einem audiovisuellen Archiv?



1. Schritt: Digitalisierung analoger AV-Medien

Damit audiovisuelle Daten einer computer-gestützten gezielten Suche zugänglich werden, müssen sie zuerst digitalisiert werden.



Wie findet man etwas in einem audiovisuellen Archiv?



1. Schritt: Digitalisierung analoger AV-Medien

Damit audiovisuelle Daten einer computer-gestützten gezielten Suche zugänglich werden, müssen sie zuerst digitalisiert werden.



2. Schritt: Verschlagwortung

Damit audiovisuelle Daten einer computergestützten gezielten Suche zugänglich werden, müssen Beschreibungen, Schlüsselwörter, etc. üblicherweise Textform vorliegen.

Wie findet man etwas in einem audiovisuellen Archiv?

- Zur gezielten Suche in audiovisuellen Medien benötigen wir **textuelle Beschreibungen**
 - des Inhalts
 - des Produktionsprozesses
 - der technischen Parameter
 - etc....
- Metadaten für AV-Inhalte werden Heute meist immer noch **manuell** erstellt



➔ *Manuelle Audio-/Videoanalyse*

metadata
describe
information
Data
one
systems
entities
structured
context
model
objects
definitions
code
people
Data

Automatisierte Audio- und Videoanalyse



- automatische inhaltliche Analyse ist
- schwierig und
 - berechnungs-/speicheraufwändig

Automatisierte Audio- und Videoanalyse



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Automatisierte Audio- und Videoanalyse



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Person



Automatisierte Audio- und Videoanalyse



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Text

Person



Automatisierte Audio- und Videoanalyse



- automatische inhaltliche Analyse ist
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Text

Person

Logo



Automatisierte Audio- und Videoanalyse



- automatische inhaltliche Analyse ist
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Text

Studio-
aufnahme

Person

Logo



Automatisierte Audio- und Videoanalyse



- automatische inhaltliche Analyse ist
- schwierig und
 - berechnungs-/speicheraufwändig

Text

Studio-
aufnahme

Person

Logo



Audio-Information

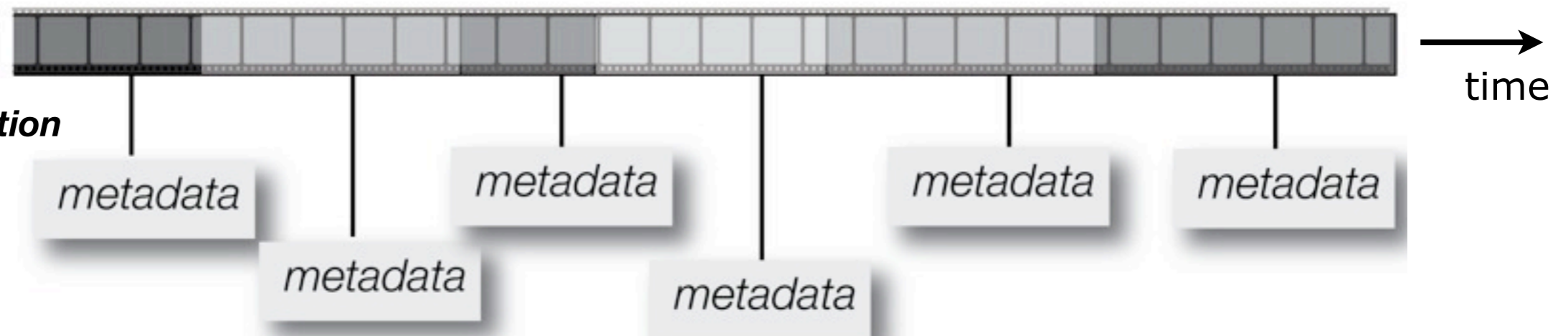


Automatisierte Audio- und Videoanalyse

- Ergebnis: Videosegmente mit zugeordneten, zeitbezogenen Metadaten



Metadata Extraction



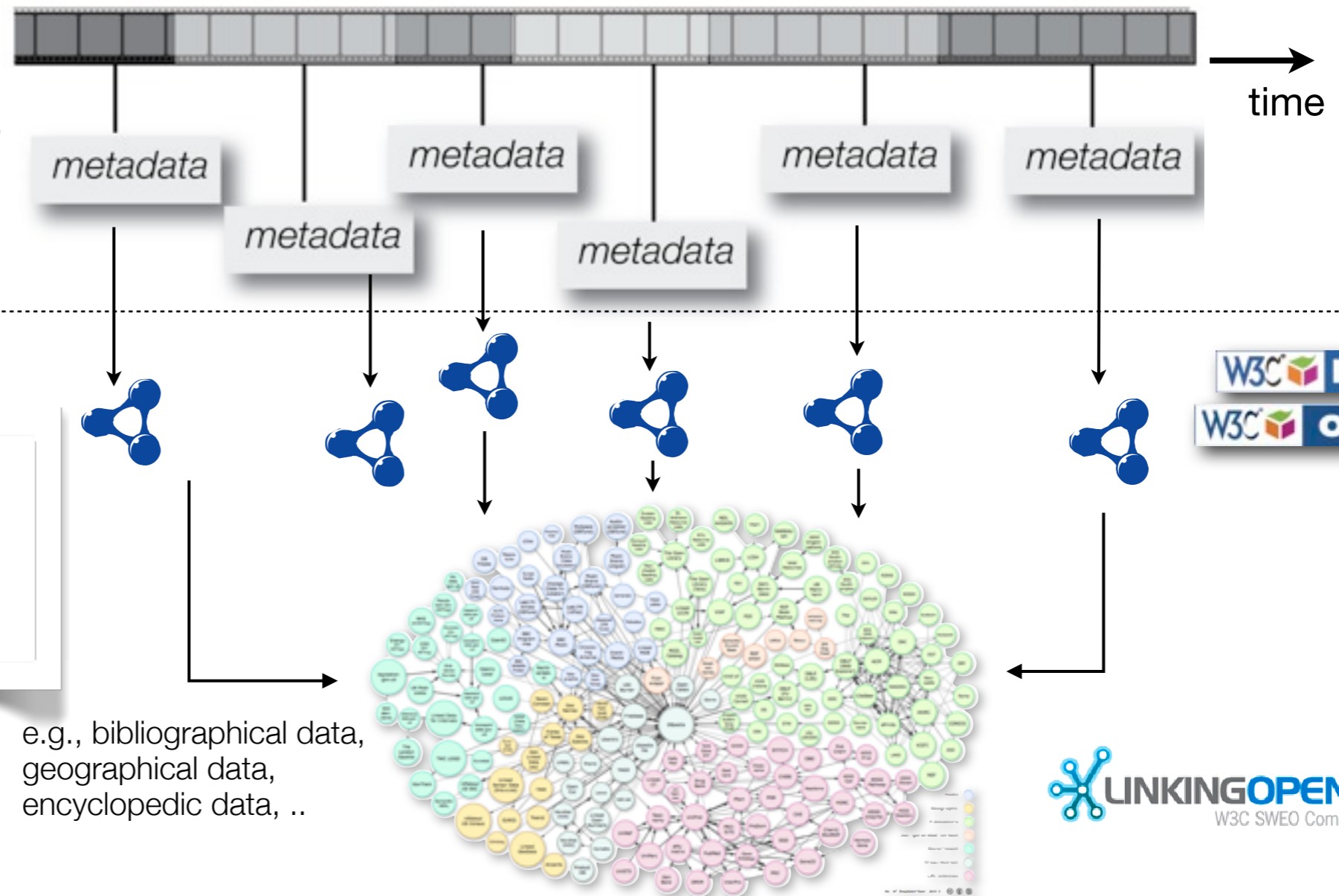
- **Metadaten** setzen sich zusammen aus kombinierten Low Level / High Level Deskriptoren
- **Metadaten** als Basis für traditionelles und semantisches Information Retrieval

Semantische Analyse



**Video Analyse /
Metadaten Extraktion**

**Entity Recognition/
Mapping**





DDR x 1983 - 1995 x Walter Ulbricht x Berliner Mauer x

Sort by Relevance Sort by Date Sort Alphabetically

Not Viewed Yet Already Viewed

Explore

Helmut Kohl Lorem Ipsum Dolor Sit Ipsum
Ipsum Lorem Lorem Ipsum Lorem

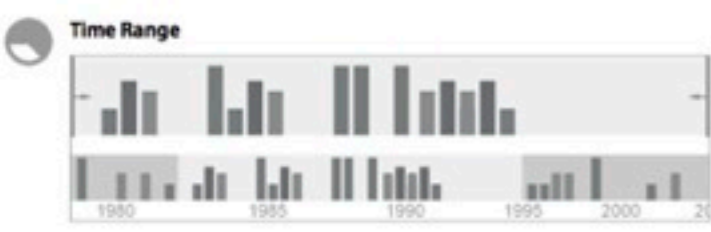
Brandenburg Leipzig Potsdam Bonn
München Washington Moskau

Wiedervereinigung Gründung der BRD

Lorem Ipsum Grundgesetz der Bundesrepublik Deutschland
Dolor Sit
Ipsum Dolor Sit Lorem Ipsum

Facets

<p>Persons (78)</p> <ul style="list-style-type: none"> Walter Ulbricht 21k Erich Honecker 85 Günther Schabowski 32 Lorem Ipsum 13 Ipsum Dolor Sit 2 	<p>Places (13)</p> <ul style="list-style-type: none"> Berlin 21k Brandenburger Tor 85 Bornholmer Straße 32 Palast der Republik 13 Oberbaumbrücke 2 	<p>Events (11)</p> <ul style="list-style-type: none"> Mauerfall 21k Deutsche Einheit 85 09. November 1989 32 Wende 13 Friedliche Revolution 2
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DDR Magazin
1-13-1970 - 1-1970

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

40. Jahrestag der DDR

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

DDRMagazin 1

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

DDRMagazin 2

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

DDRMagazin 3

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

Weihnachten der 40er Jahre

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

DDR Magazin
Sammelband 2 - 1996-09

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

DDR Magazin
Sammelband 2 - 1996-10

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

149 Tage nach der Revolution

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

Rede von E. Krenz

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

We Shall Overcome

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

DDR Lebensmittel 1

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

DDR Lebensmittel 2

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

Mauerabbriss
Waldemarstrasse (Teil 1/2)

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

Interview mit
Politbüromitglied
Werner Eberlein

DDR Walter Ulbricht
Berliner Mauer Mauerfall SED

< 15

0 - 300 300 - 600 600 - 900 900 - 1200 1200 - 1500 1500 - 1800 < 2018

Automatisierte Audio-/Videoanalyse

- **Strukturelle Analyse**
- **Intelligent Character Recognition (ICR)**
 - Character/Logo Detection
 - Character Filtering
 - Character Recognition
- *Audio Analyse*
 - *Speaker Detection*
 - *Automated Speech Recognition (ASR)*
- *Genre Analyse*
- *Face/Body Detection & Clustering*

Semantische Analyse

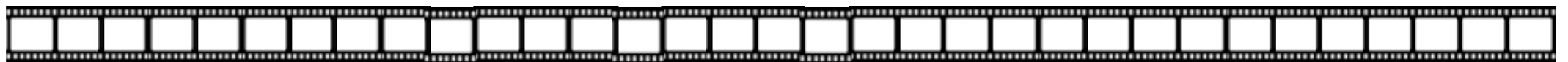
Semantische Suche

Strukturelle Analyse



- Automatische strukturelle Gliederung von AV-Daten
- Zerlegung des Videodatenstroms in inhaltlich kohärente Abschnitte (Segmente)

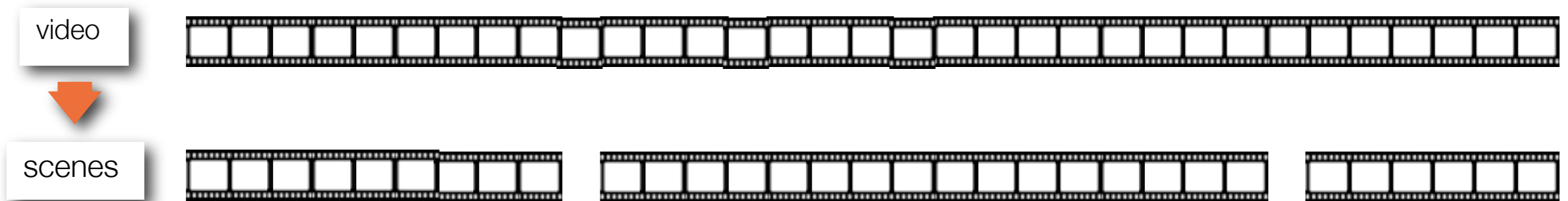
video



Strukturelle Analyse



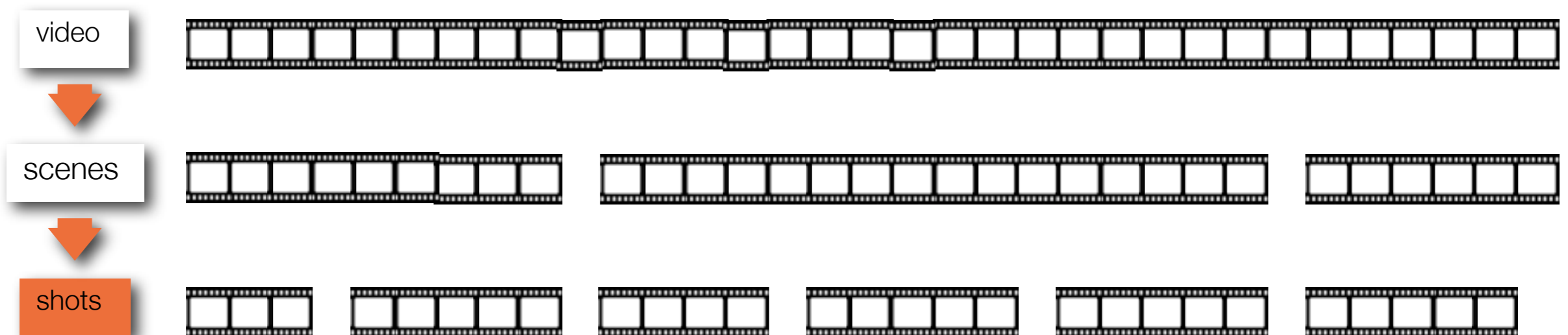
- Automatische strukturelle Gliederung von AV-Daten
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Strukturelle Analyse



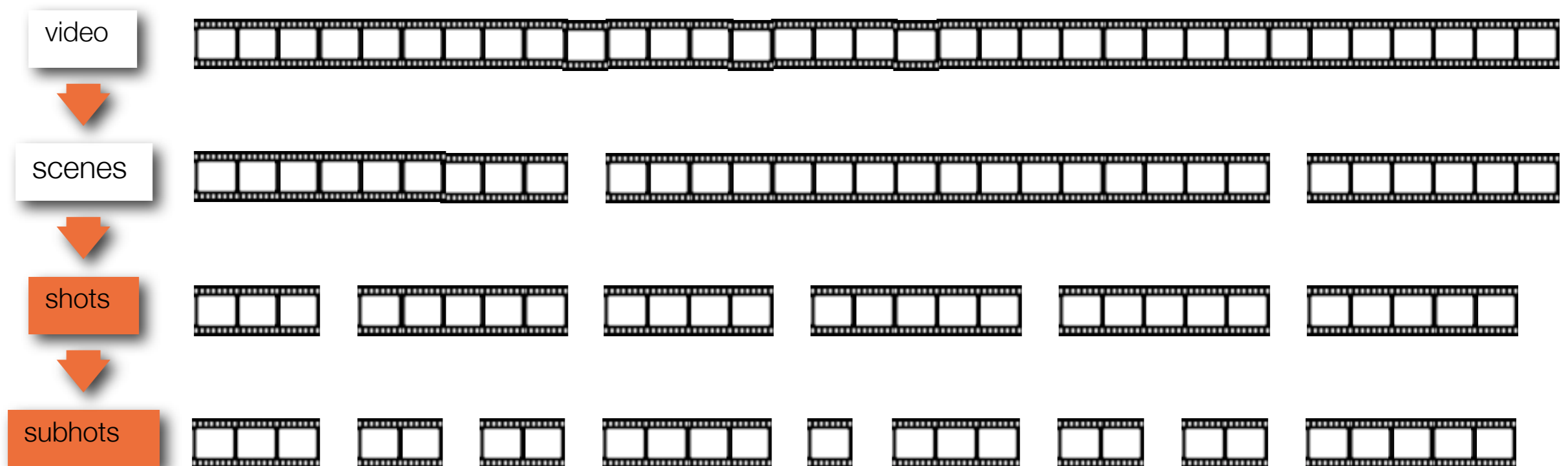
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Strukturelle Analyse



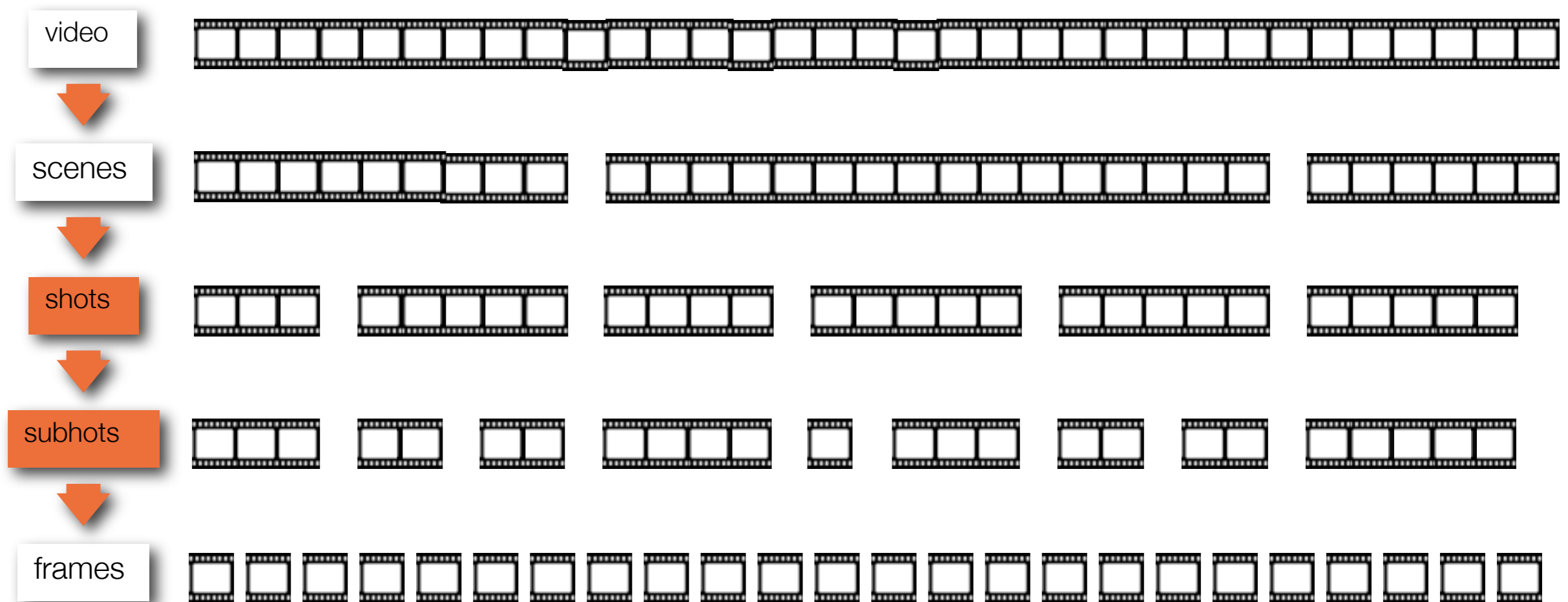
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Strukturelle Analyse



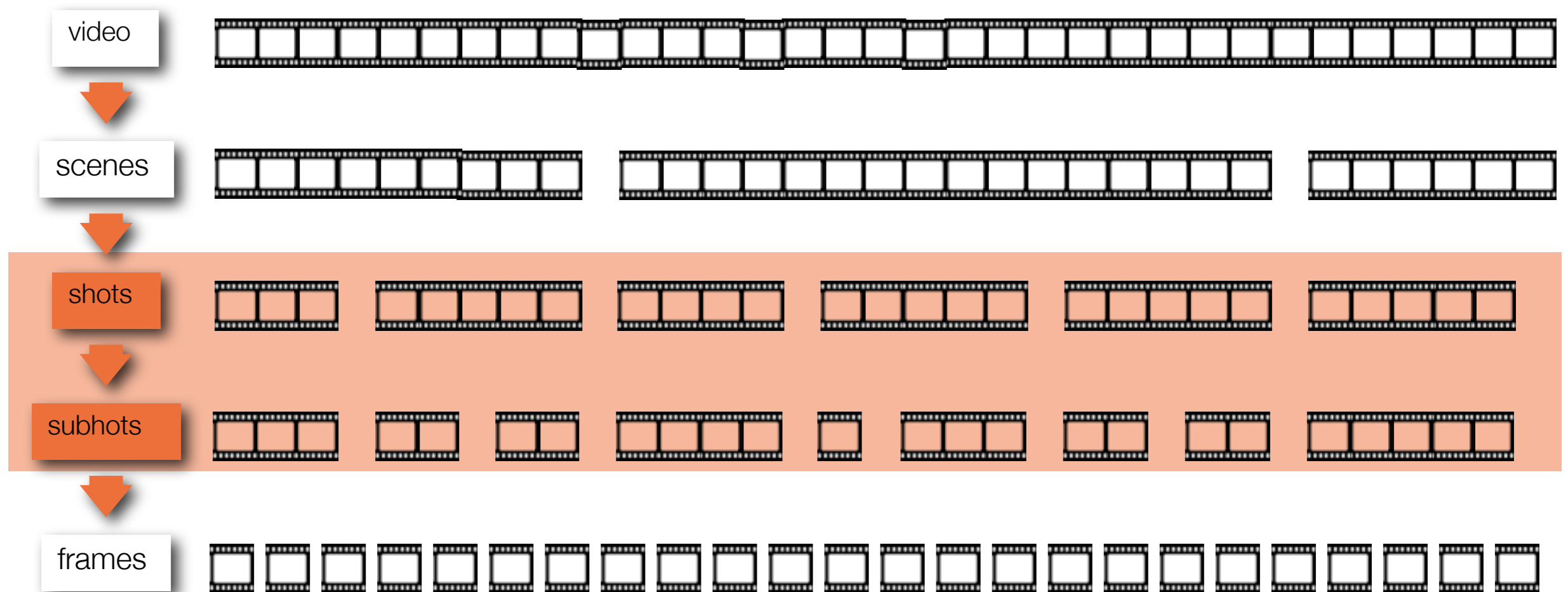
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Strukturelle Analyse



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- Zerlegung des Videodatenstroms in inhaltlich kohärente Abschnitte (Segmente)



Strukturelle Analyse

- *Shot Boundary Detection*

shots



- Identification of
 - Hard Cuts
 - Drop Outs
 - Soft Cuts, as e.g., Dissolve, Wipe, Cross-Fade, etc.

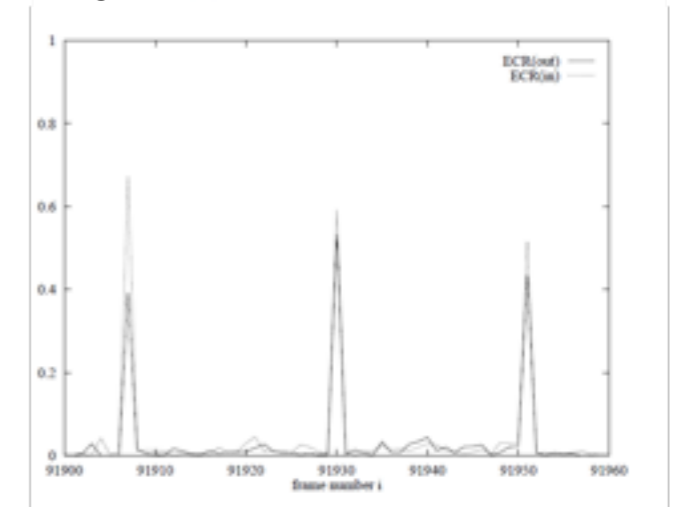
Analytical Shot Boundary Detection

- Analysis of Luminance/Chrominance Histograms
- Analysis of Edge Distribution
- Analysis of Motion Vectors

Machine Learning

- Classification of Hard/Soft Cuts based on Image Features
- K-Nearest Neighbor
- Random Forrest
- Support Vector Machines

Histogram Difference Analysis



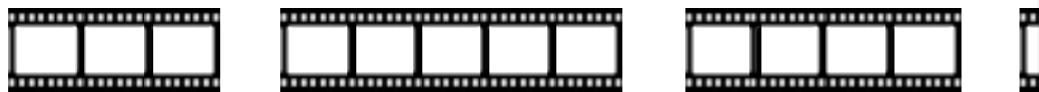
Motion Vector Analysis



Strukturelle Analyse

- Shot Boundary Detection

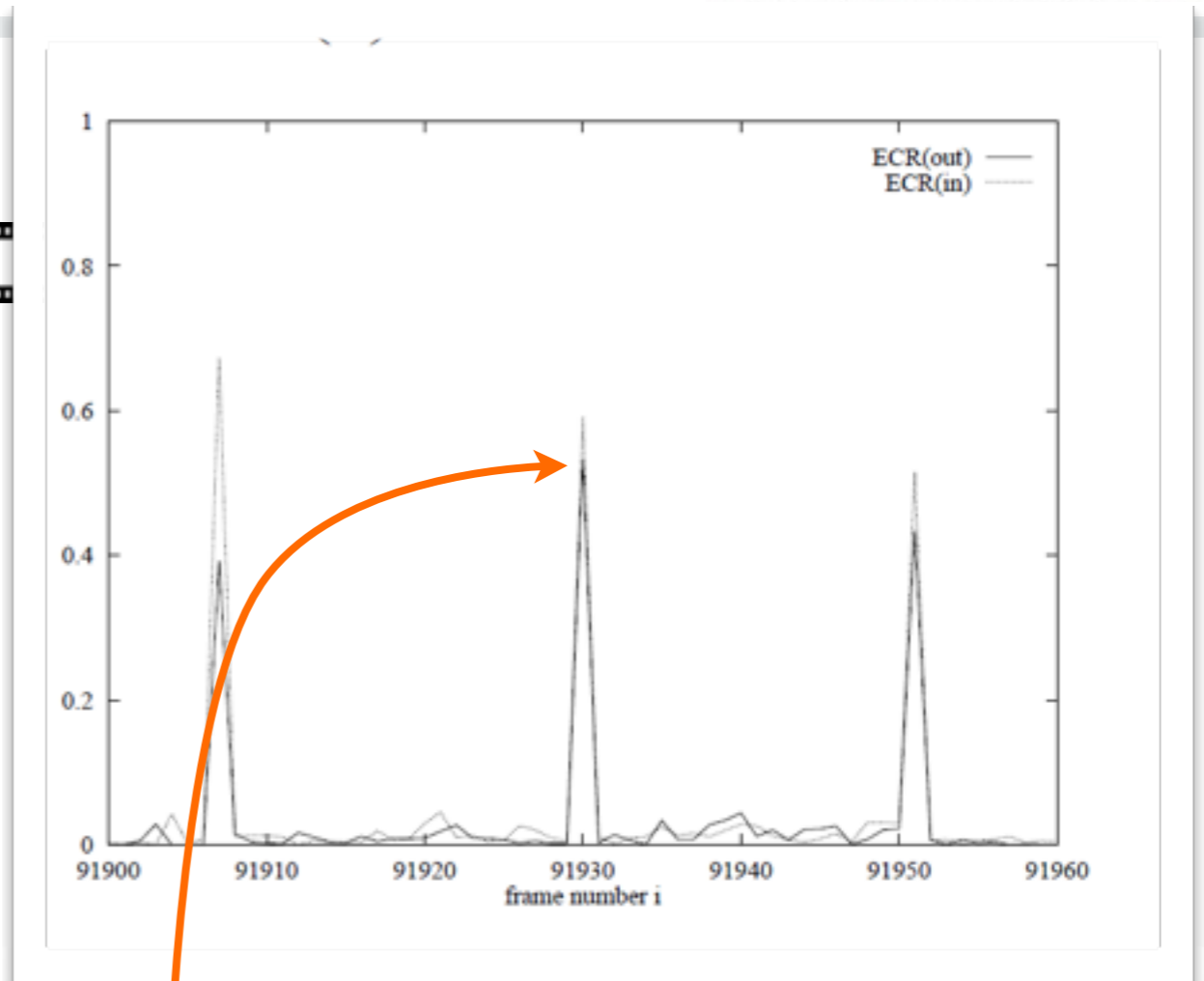
shots



- Identification of
 - **Hard Cuts**

Feature Analysis

- Luminance Histogram Difference
- Chrominance Histogram Difference
- Edge Distribution



91927

91928

91929

91930

91931

91932

Strukturelle Analyse

- Shot Boundary Detection

shots



- Identification of
 - Hard Cuts
 - **Drop Outs**

Histogram/Chrominance Difference Analysis



Drop Out

Strukturelle Analyse

- *Shot Boundary Detection*

shots



- Identification of
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Fade Out



Fade In

Strukturelle Analyse

- *Shot Boundary Detection*

shots



- Identification of
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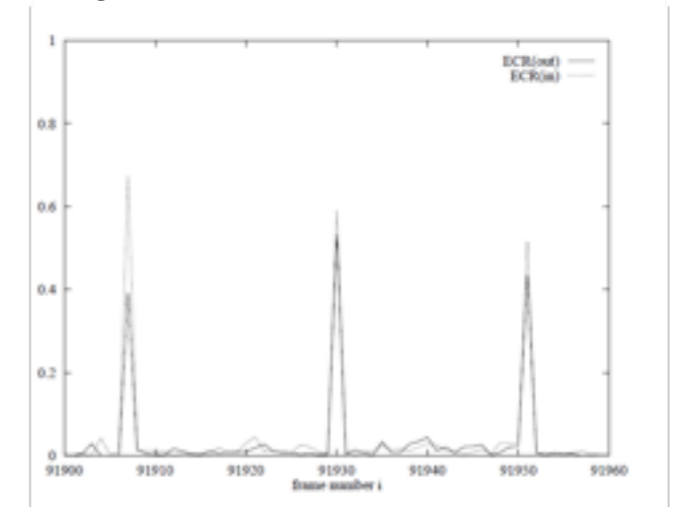
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Histogram Difference Analysis



Motion Vector Analysis



Automatisierte Audio- und Videoanalyse



Character Detection
Character Recognition

Face-Detection
Face Clustering
Face Tracking

Logo-Detection

Genre
Detection



Automatisierte Audio- und Videoanalyse



Character Detection
Character Recognition

Face-Detection
Face Clustering
Face Tracking

Logo-Detection

Genre
Detection



Automatisierte Audio- und Videoanalyse



Intelligent Character Recognition

- **Preprocessing**
 - Character Identification
 - Text Preprocessing
 - Text Filtering
 - Adaption of script geometry (Deskew)
 - Image quality enhancement
- **Optical Character Recognition (OCR)**
 - Standard OCR software (OCRopus)
- **Postprocessing**
 - Lexical analysis
 - Statistical / context based filtering



Ermittlungen nach
Bombenfunden

Ermittlungen nach
Bombenfunden

Ermittlungen nach
Bombenfunden

Intelligent Character Recognition

- **Preprocessing**

- Character Identification

Filtering

- **Local Binary Patterns (LBP)**
 - Histogram of Oriented Gradients



Intelligent Character Recognition

- **Preprocessing**

- Character Identification

Filtering

- Local Binary Patterns (LBP)
- **Histogram of Oriented Gradients**



Intelligent Character Recognition

- **Preprocessing**

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Automatisierte Audio- und Videoanalyse



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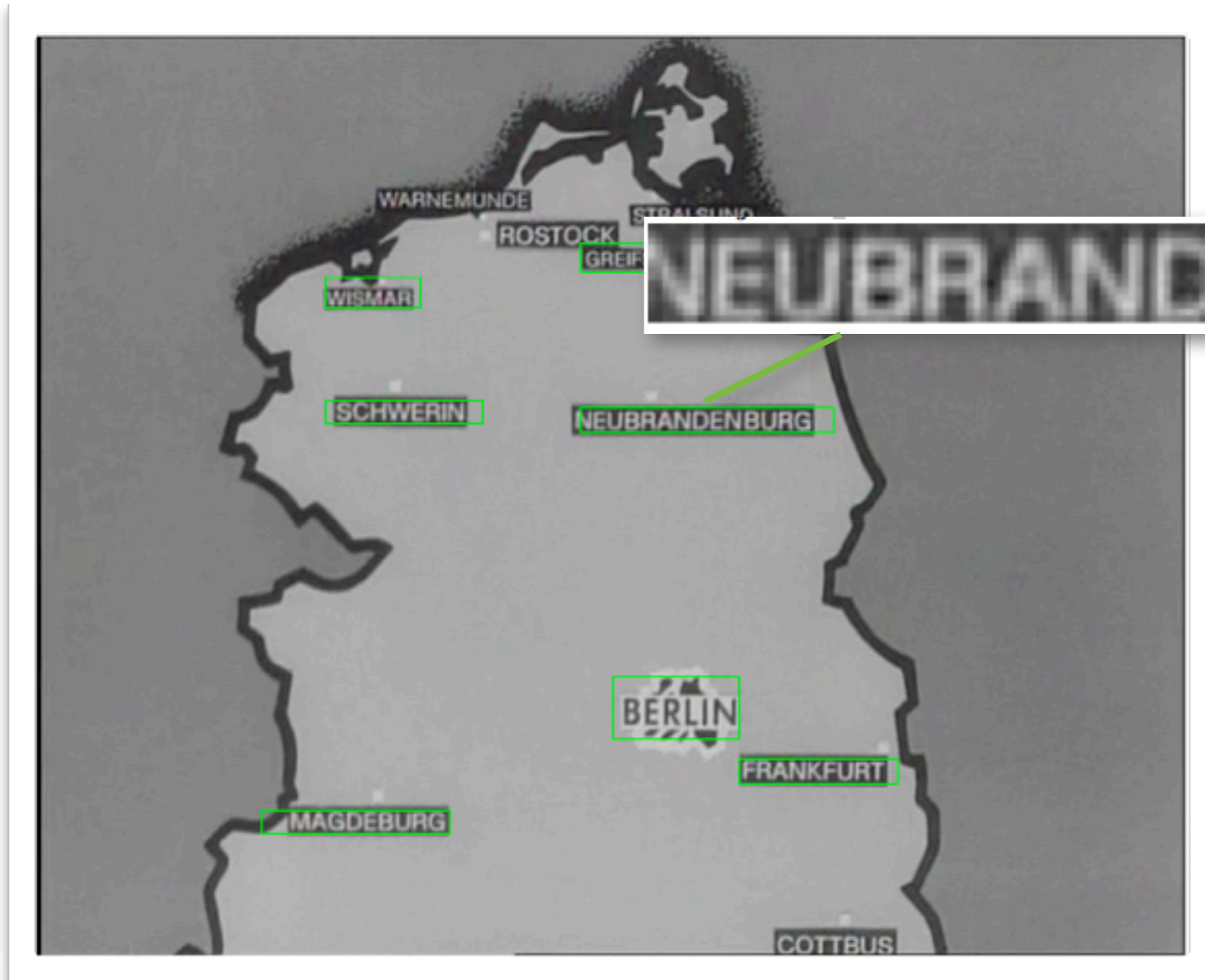


Ermittlungen nach
Bombenfunden

Ermittlungen nach
Bombenfunden

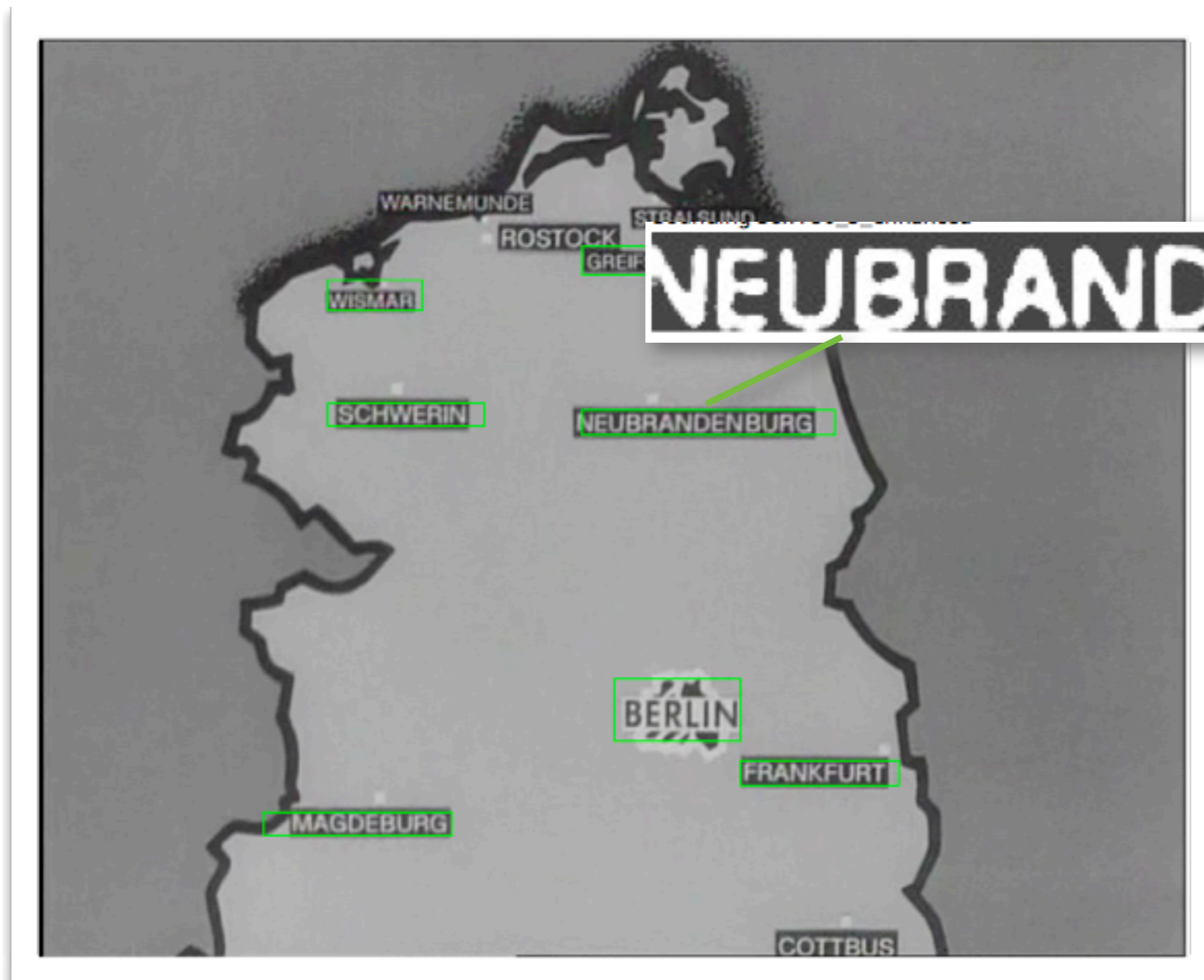
Ermittlungen nach
Bombenfunden

Intelligent Character Recognition



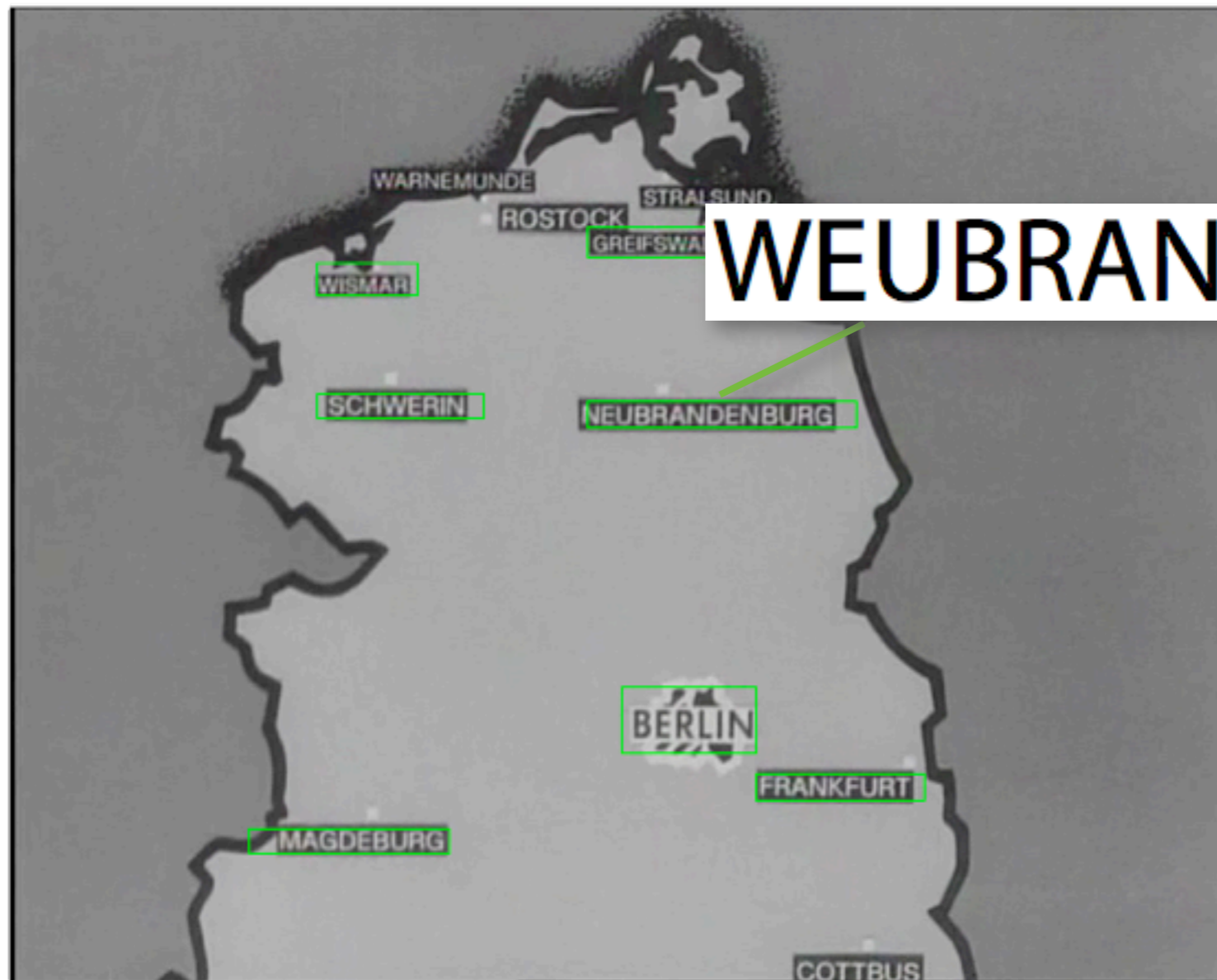
Original Image Bounding Box

Intelligent Character Recognition



Advanced Image Enhancement

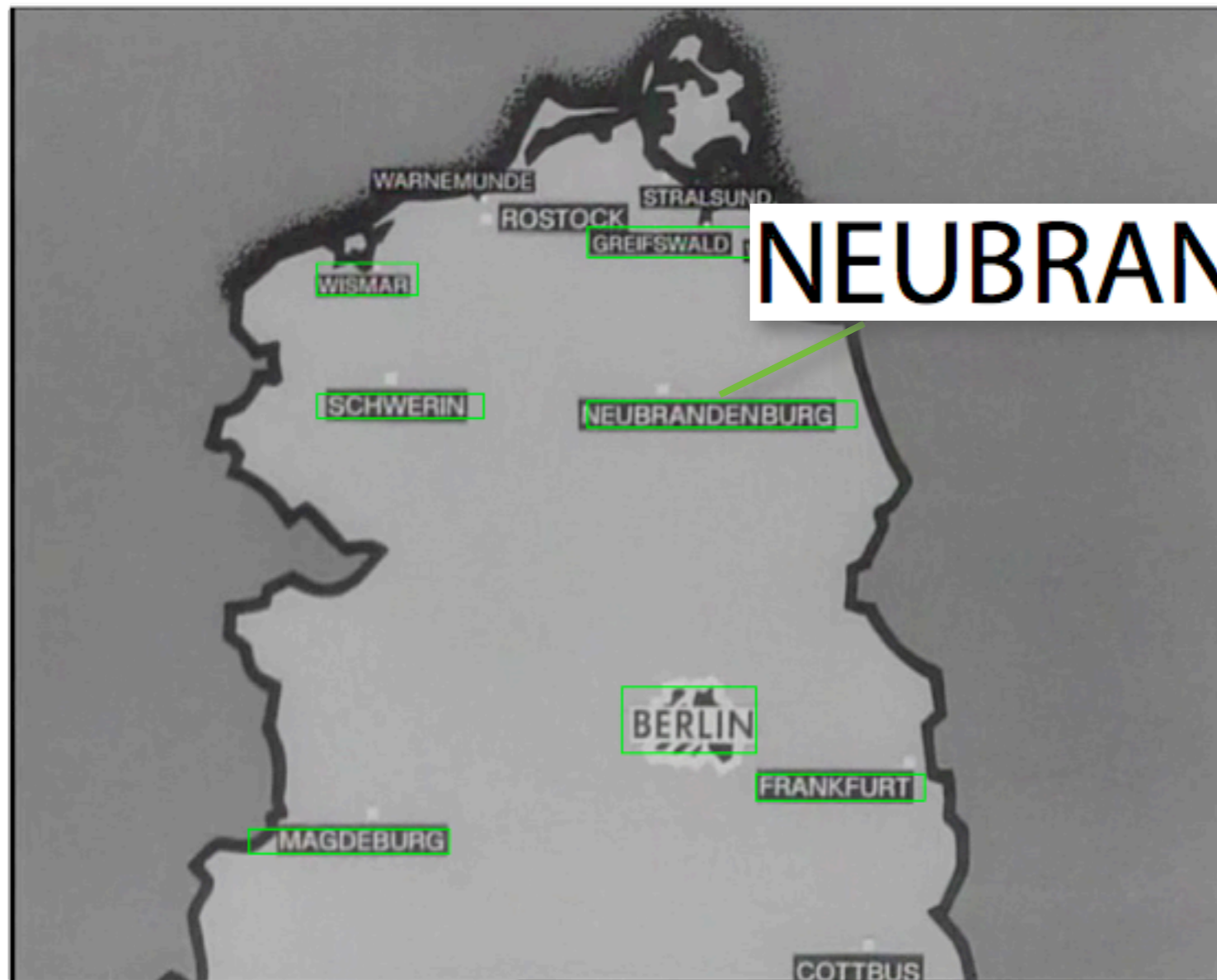
Intelligent Character Recognition



Standard OCR (OCROPUS)

WEUBRANDENBURG.

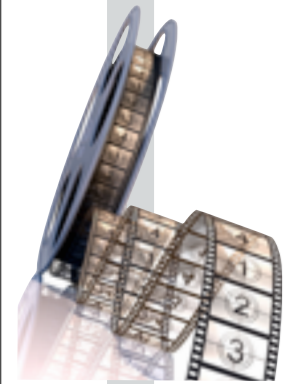
Intelligent Character Recognition



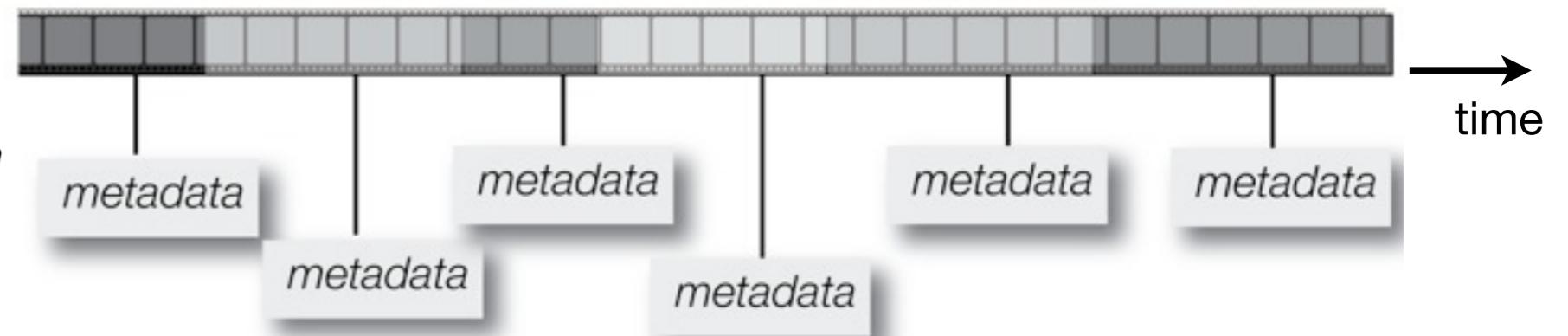
Context-based Spell Correction

NEUBRANDENBURG

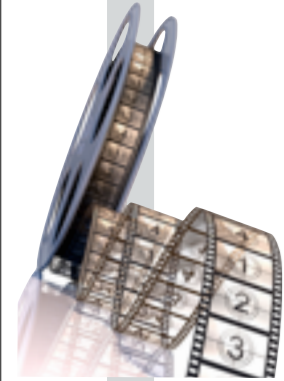
Semantische Analyse



**Video Analyse /
Metadaten Extraktion**



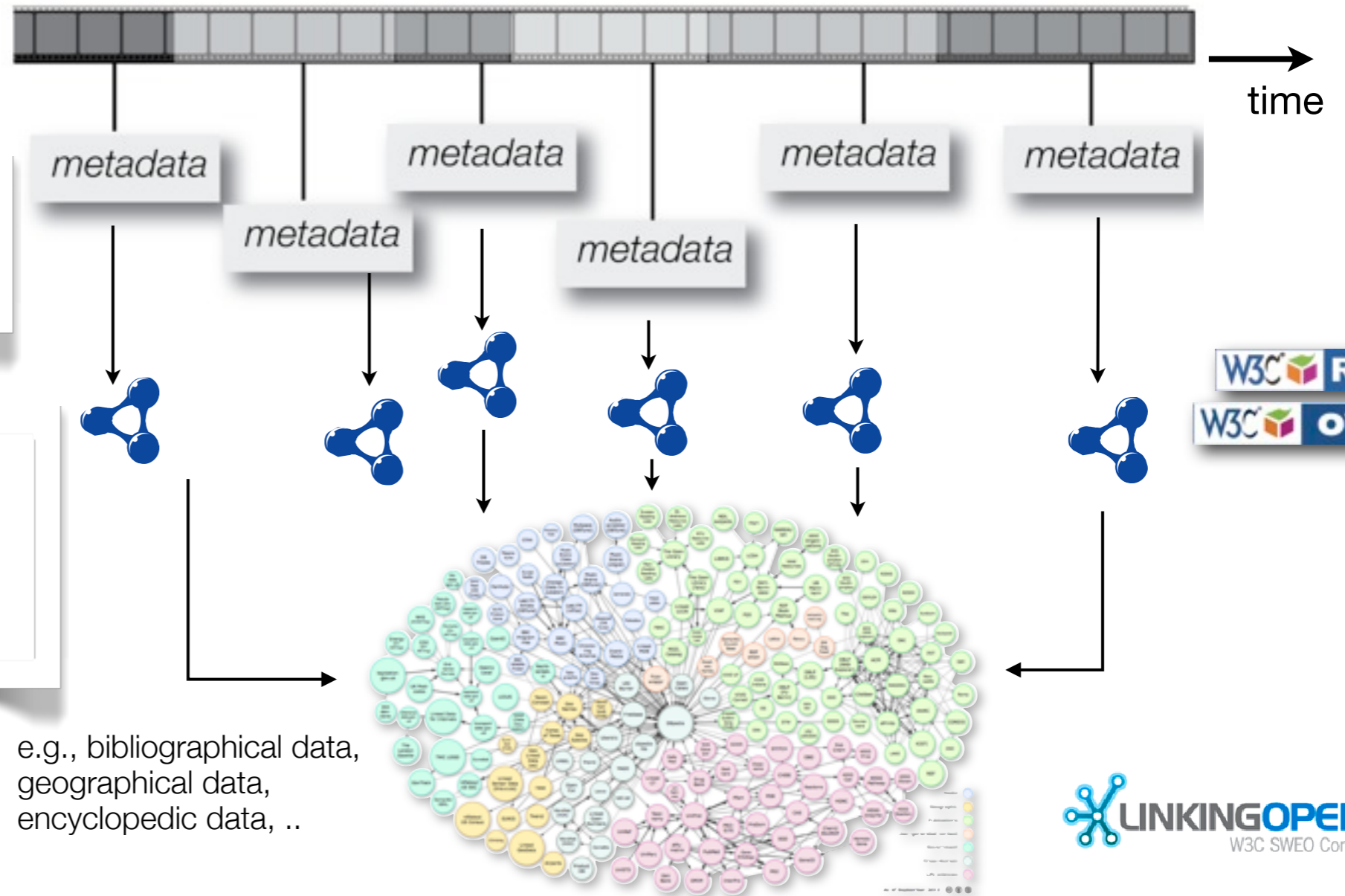
Semantische Analyse



**Video Analyse /
Metadaten Extraktion**

**Entity Recognition/
Mapping**

e.g.,
person xy
location yz
event abc



Semantische Analyse

- *Named Entity Recognition*
 - Mapping keyterms (text) to semantic entities
 - **Context Analysis** and **Disambiguation**

Semantische Analyse

- *Named Entity Recognition*
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Semantische Analyse

- *Named Entity Recognition*
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Truman

Keyterm / User Tag

Semantische Analyse

- *Named Entity Recognition*
 - Mapping keyterms (text) to semantic entities
 - **Context Analysis** and **Disambiguation**



Truman

Keyterm / User Tag

Semantic Entities

Truman Capote



?

Harry S. Truman



?

Truman, Minnesota



?

The Truman Show



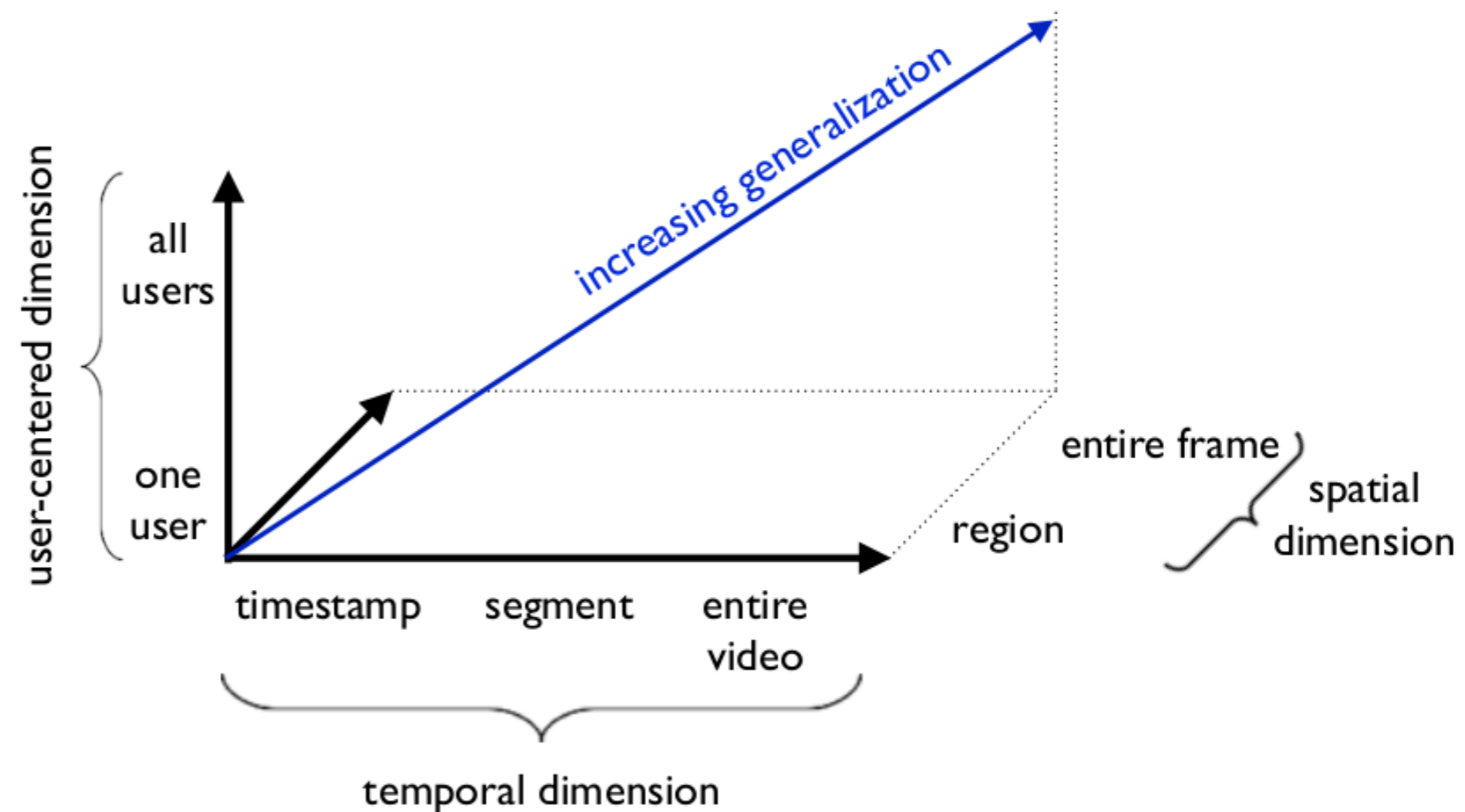
?

Semantische Analyse

Contextanalyse und Disambiguierung

What defines a Context in AV-Data?

- Temporal Coherence
- Spatial Coherence
- Provenance

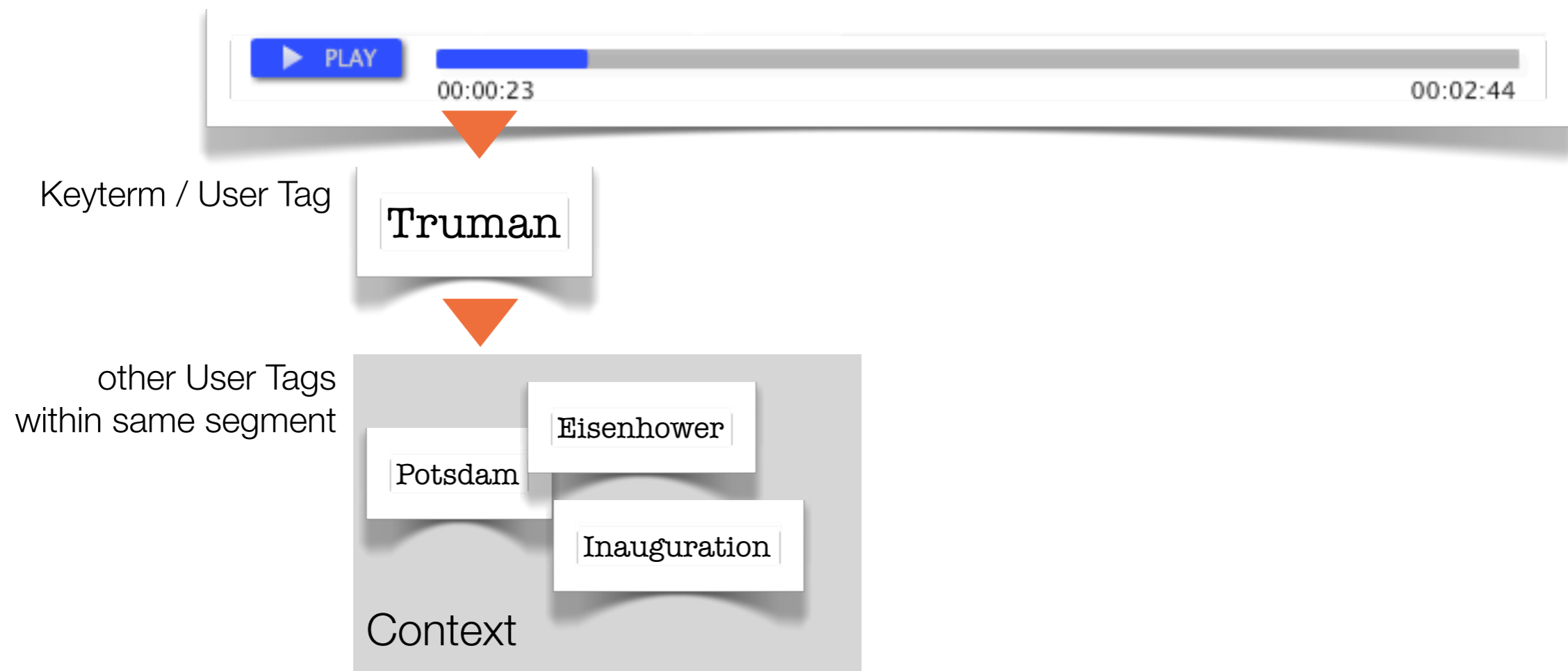


Semantische Analyse

Contextanalyse und Disambiguierung

What defines a Context in AV-Data?

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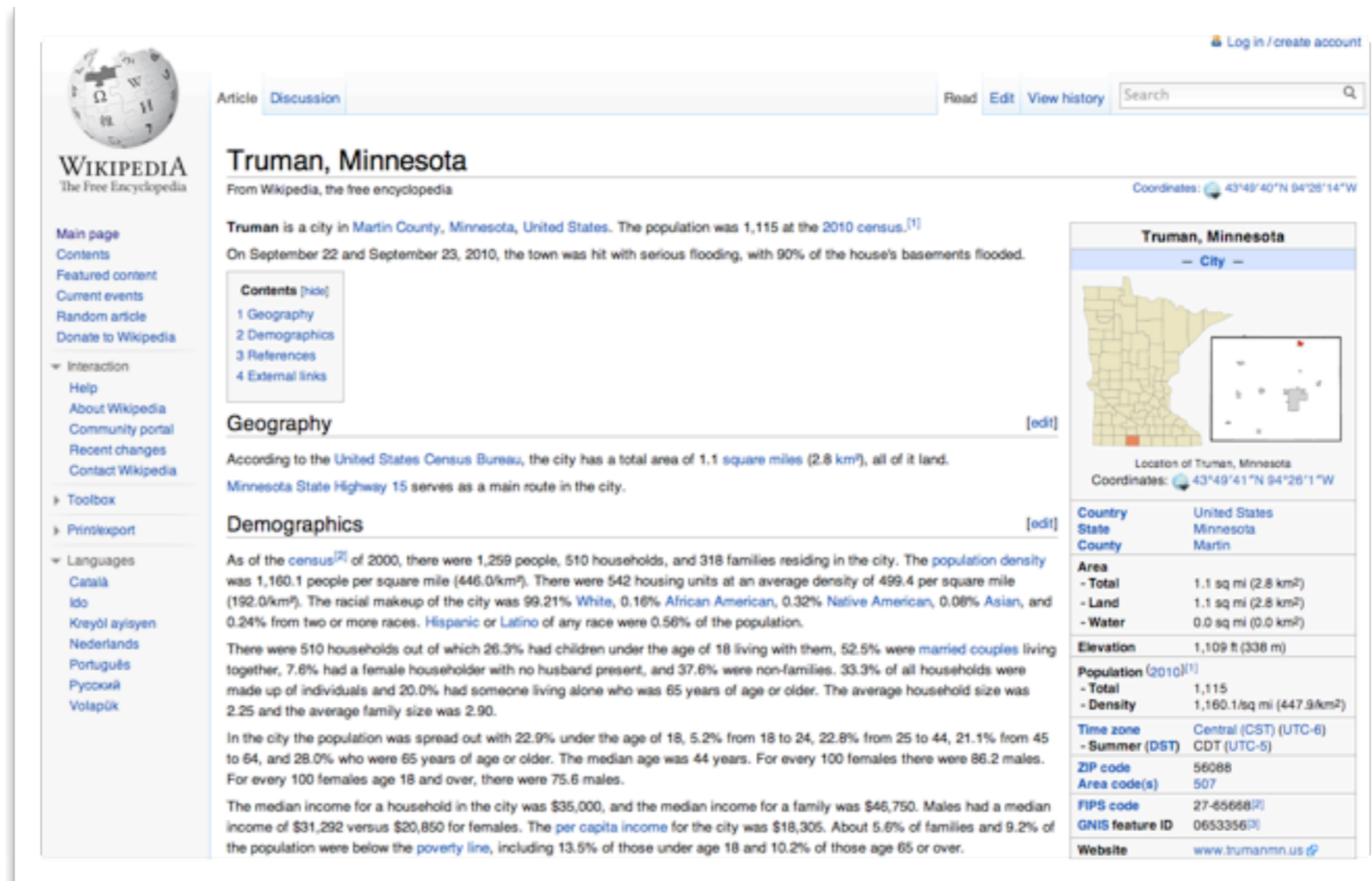
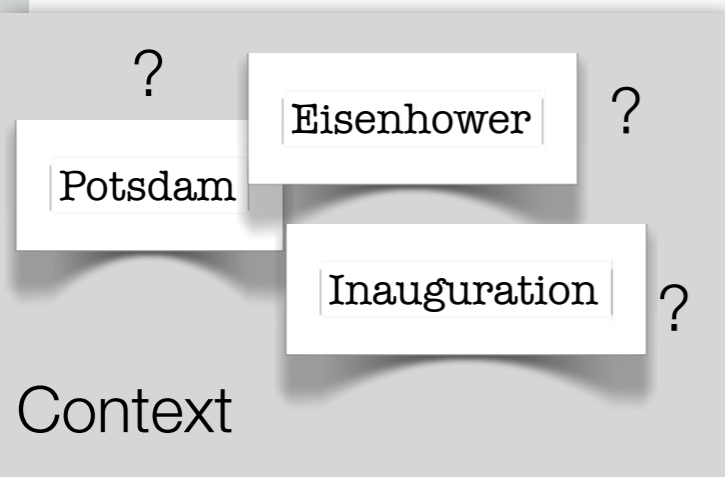
Semantische Analyse

Contextanalyse und Disambiguierung

(1) Co-occurrence Analyse

based on wikipedia

Truman



WIKIPEDIA The Free Encyclopedia

Truman, Minnesota

From Wikipedia, the free encyclopedia

Coordinates: 43°49′40″N 94°26′14″W﻿ / ﻿43.82778°N 94.43722°W﻿ / 43.82778; -94.43722

Truman is a city in **Martin County, Minnesota, United States**. The population was 1,115 at the 2010 census.^[1] On September 22 and September 23, 2010, the town was hit with serious flooding, with 90% of the house's basements flooded.

Contents [hide]

- Geography
- Demographics
- References
- External links

Geography

According to the **United States Census Bureau**, the city has a total area of 1.1 square miles (2.8 km²), all of it land. **Minnesota State Highway 15** serves as a main route in the city.

Demographics

As of the census^[2] of 2000, there were 1,259 people, 510 households, and 318 families residing in the city. The population density was 1,160.1 people per square mile (446.0/km²). There were 542 housing units at an average density of 499.4 per square mile (192.0/km²). The racial makeup of the city was 99.21% **White**, 0.16% **African American**, 0.32% **Native American**, 0.08% **Asian**, and 0.24% from two or more races. **Hispanic** or **Latino** of any race were 0.56% of the population.

There were 510 households out of which 26.3% had children under the age of 18 living with them, 52.5% were **married couples** living together, 7.6% had a female householder with no husband present, and 37.6% were non-families. 33.3% of all households were made up of individuals and 20.0% had someone living alone who was 65 years of age or older. The average household size was 2.25 and the average family size was 2.90.

In the city the population was spread out with 22.9% under the age of 18, 5.2% from 18 to 24, 22.8% from 25 to 44, 21.1% from 45 to 64, and 28.0% who were 65 years of age or older. The median age was 44 years. For every 100 females there were 86.2 males. For every 100 females age 18 and over, there were 75.6 males.

The median income for a household in the city was \$35,000, and the median income for a family was \$46,750. Males had a median income of \$31,292 versus \$20,850 for females. The **per capita income** for the city was \$18,305. About 5.6% of families and 9.2% of the population were below the **poverty line**, including 13.5% of those under age 18 and 10.2% of those age 65 or over.

Country	United States
State	Minnesota
County	Martin
Area	
- Total	1.1 sq mi (2.8 km ²)
- Land	1.1 sq mi (2.8 km ²)
- Water	0.0 sq mi (0.0 km ²)
Elevation	1,109 ft (338 m)
Population (2010) ^[1]	
- Total	1,115
- Density	1,160.1/sq mi (447.9/km ²)
Time zone	Central (CST) (UTC-6)
- Summer (DST)	CDT (UTC-5)
ZIP code	56088
Area code(s)	507
FIPS code	27-65668 ^[2]
GNIS feature ID	0653356 ^[3]
Website	www.trumanmn.us ^[4]

Do context terms co-occur in matching wikipedia article?

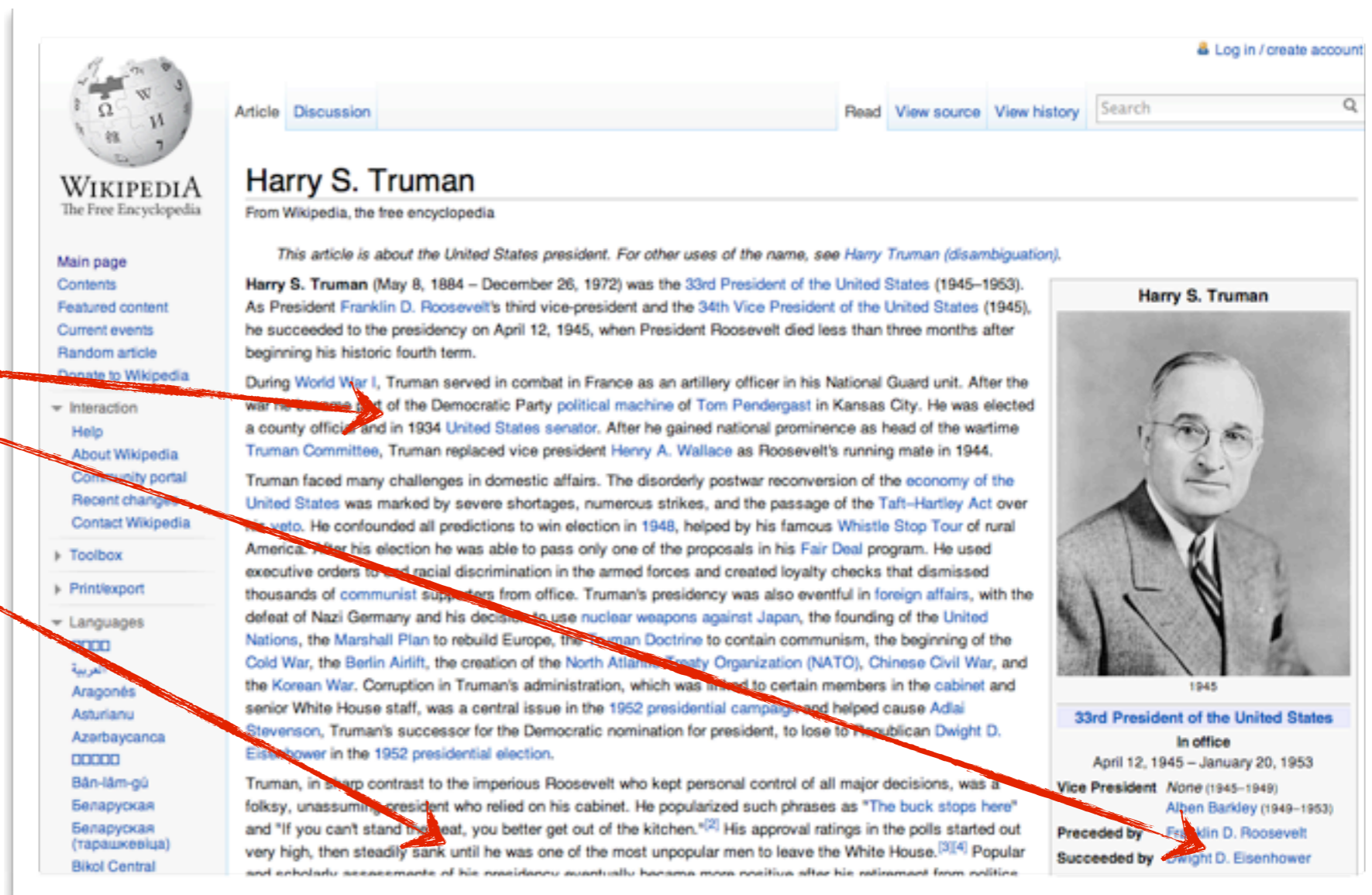
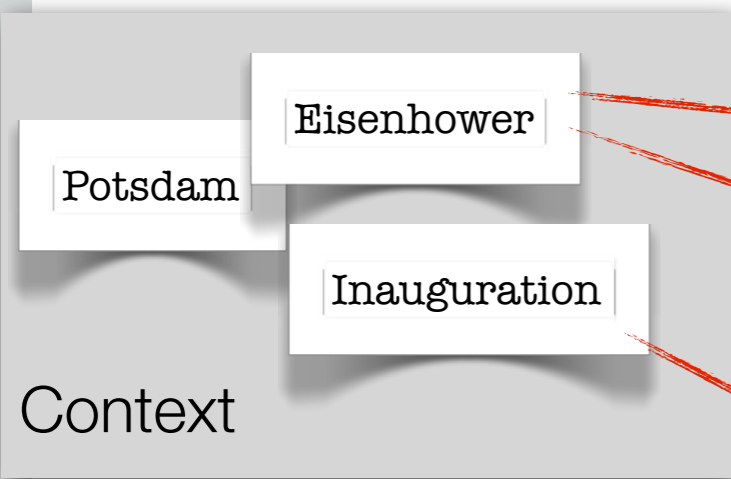
Semantische Analyse

Contextanalyse und Disambiguierung

(1) Co-occurrence Analyse

based on wikipedia

Truman



WIKIPEDIA The Free Encyclopedia

Harry S. Truman

From Wikipedia, the free encyclopedia

This article is about the United States president. For other uses of the name, see [Harry Truman \(disambiguation\)](#).

Harry S. Truman (May 8, 1884 – December 26, 1972) was the 33rd President of the United States (1945–1953). As President [Franklin D. Roosevelt](#)'s third vice-president and the 34th Vice President of the United States (1945), he succeeded to the presidency on April 12, 1945, when President Roosevelt died less than three months after beginning his historic fourth term.

During [World War I](#), Truman served in combat in France as an artillery officer in his National Guard unit. After the war he became part of the Democratic Party political machine of [Tom Pendergast](#) in Kansas City. He was elected a county official and in 1934 [United States senator](#). After he gained national prominence as head of the wartime Truman Committee, Truman replaced vice president [Henry A. Wallace](#) as Roosevelt's running mate in 1944.

Truman faced many challenges in domestic affairs. The disorderly postwar reconversion of the [economy of the United States](#) was marked by severe shortages, numerous strikes, and the passage of the [Taft–Hartley Act](#) over his veto. He confounded all predictions to win election in 1948, helped by his famous [Whistle Stop Tour](#) of rural America. After his election he was able to pass only one of the proposals in his [Fair Deal](#) program. He used executive orders to end racial discrimination in the armed forces and created loyalty checks that dismissed thousands of [communist](#) supporters from office. Truman's presidency was also eventful in foreign affairs, with the defeat of [Nazi Germany](#) and his decision to use [nuclear weapons against Japan](#), the founding of the [United Nations](#), the [Marshall Plan](#) to rebuild Europe, the [Truman Doctrine](#) to contain communism, the beginning of the [Cold War](#), the [Berlin Airlift](#), the creation of the [North Atlantic Treaty Organization \(NATO\)](#), [Chinese Civil War](#), and the [Korean War](#). Corruption in Truman's administration, which was linked to certain members in the cabinet and senior White House staff, was a central issue in the 1952 presidential campaign and helped cause [Adlai Stevenson](#), Truman's successor for the Democratic nomination for president, to lose to a Republican [Dwight D. Eisenhower](#) in the 1952 presidential election.

Truman, in sharp contrast to the imperious [Roosevelt](#) who kept personal control of all major decisions, was a folksy, unassuming president who relied on his cabinet. He popularized such phrases as "The buck stops here" and "If you can't stand the heat, you better get out of the kitchen."^[2] His approval ratings in the polls started out very high, then steadily sank until he was one of the most unpopular men to leave the White House.^{[3][4]} Popular and scholarly assessments of his presidency eventually became more positive after his retirement from office.

Harry S. Truman
1945
33rd President of the United States
In office
April 12, 1945 – January 20, 1953
Vice President None (1945–1949)
Alben Barkley (1949–1953)
Preceded by [Franklin D. Roosevelt](#)
Succeeded by [Dwight D. Eisenhower](#)

Disambiguation by statistical frequency

Semantische Analyse

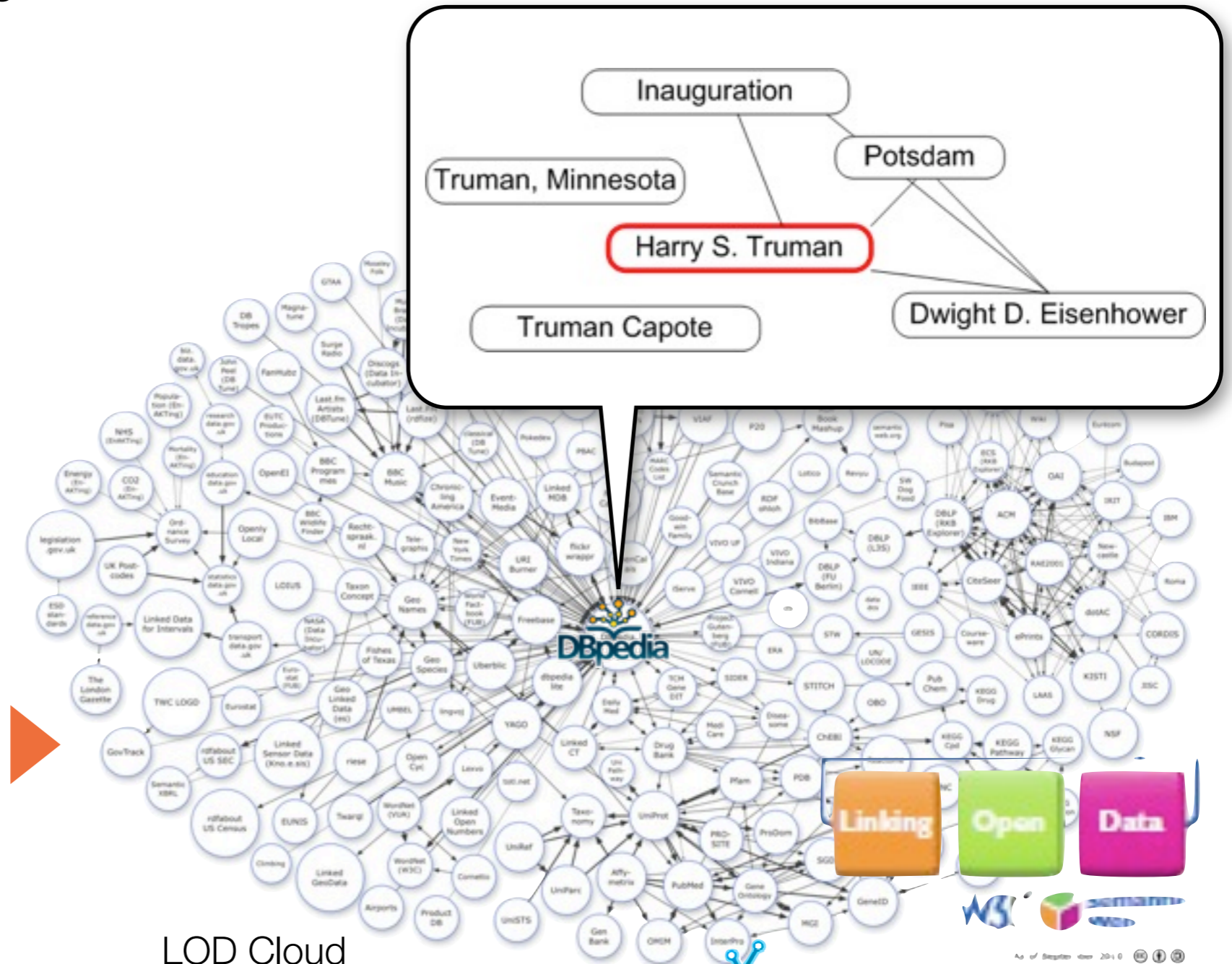
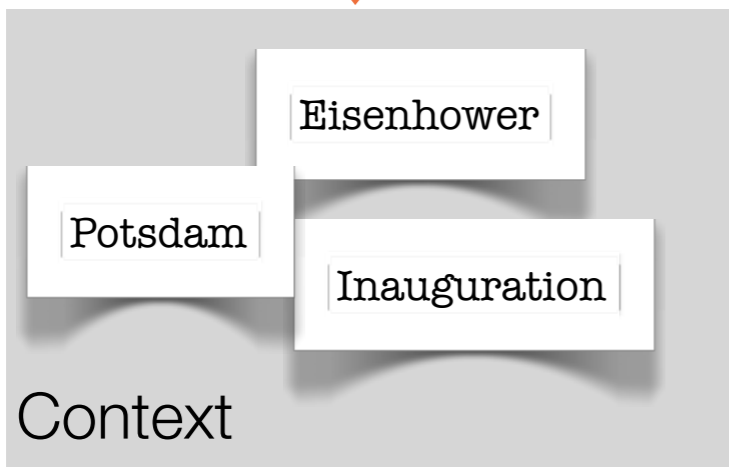
Contextanalyse und Disambiguierung

(2) Semantic Graph Analysis



Keyword / User Tag

Truman



LOD Cloud



DDR x 1983 - 1995 x Walter Ulbricht x Berliner Mauer x

Sort by Relevance Sort by Date Sort Alphabetically

Not Viewed Yet Already Viewed

Explore

Helmut Kohl Lorem Ipsum Dolor Sit Ipsum
Ipsum Lorem Lorem Ipsum Lorem

Brandenburg Leipzig Potsdam Bonn
München Washington Moskau

Wiedervereinigung Gründung der BRD

Lorem Ipsum Grundgesetz der Bundesrepublik Deutschland
Dolor Sit
Ipsum Dolor Sit Lorem Ipsum

Facets

<p>Persons (78)</p> <ul style="list-style-type: none"> Walter Ulbricht 21k Erich Honecker 85 Günther Schabowski 32 Lorem Ipsum 13 Ipsum Dolor Sit 2 	<p>Places (13)</p> <ul style="list-style-type: none"> Berlin 21k Brandenburger Tor 85 Bornholmer Straße 32 Palast der Republik 13 Oberbaumbrücke 2 	<p>Events (11)</p> <ul style="list-style-type: none"> Mauerfall 21k Deutsche Einheit 85 09. November 1989 32 Wende 13 Friedliche Revolution 2
<p>Time Range</p>	<p>Organisations (12)</p> <ul style="list-style-type: none"> Ministerrat der DDR 21k Volkskammer 85 SED 32 Ipsum 13 Lorem Ipsum 11 	<p>Things (344)</p> <ul style="list-style-type: none"> Lorem Ipsum 21k Lorem 85 Lorem Ipsum 32 Ipsum 13 Lorem Ipsum 2

- DDR Magazin 1-13-1970 - 1-1970
- 40 Jahrestag der DDR
- DDRMagazin 1
- DDRMagazin 2
- DDRMagazin 3
- Weihnachten der 40er Jahre
- DDR Magazin Sammelband 2 - 1996-09
- DDR Magazin Sammelband 2 - 1996-10
- 149 Tage nach der Revolution
- Rede von E. Krenz
- We Shall Overcome
- DDR Lebensmittel 1
- DDR Lebensmittel 2
- Mauerabbriss Waldemarstrasse (Teil 1/2)
- Interview mit Politbüromitglied Werner Eberlein

< 15

0 - 300 300 - 600 600 - 900 900 - 1200 1200 - 1500 1500 - 1800 < 2018

Semantic Media Explorer

Neue Wege der Suche in Medienarchiven



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*Vielen Dank für
Ihre Aufmerksamkeit!*

Dr. Harald Sack, 3. Leipziger Semantic Web Tag, 5. Mai 2011