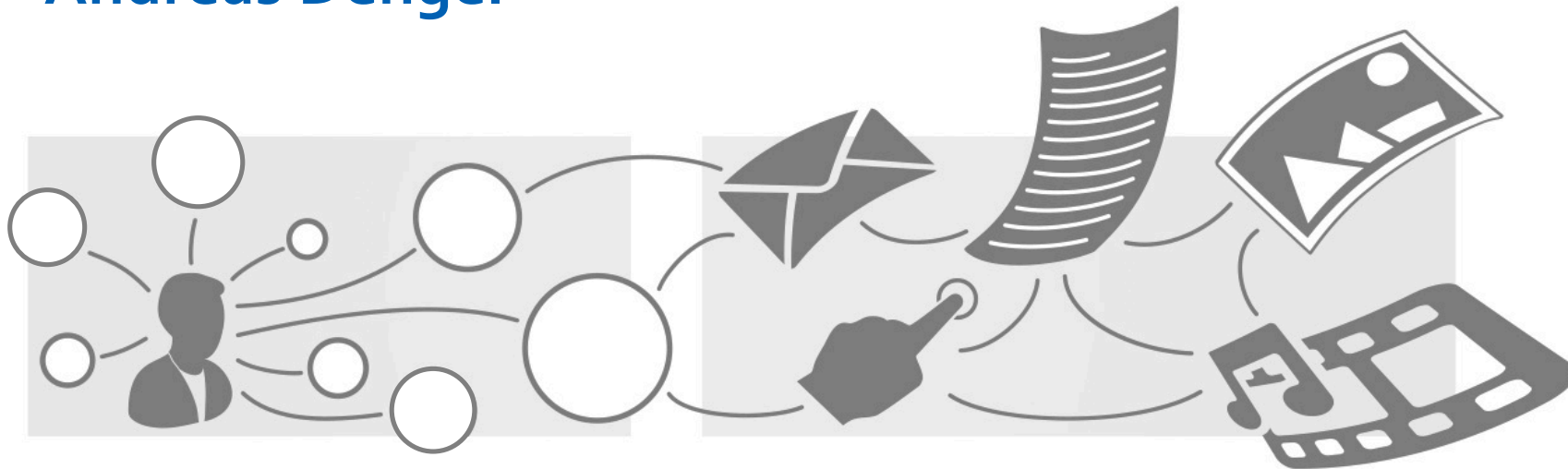
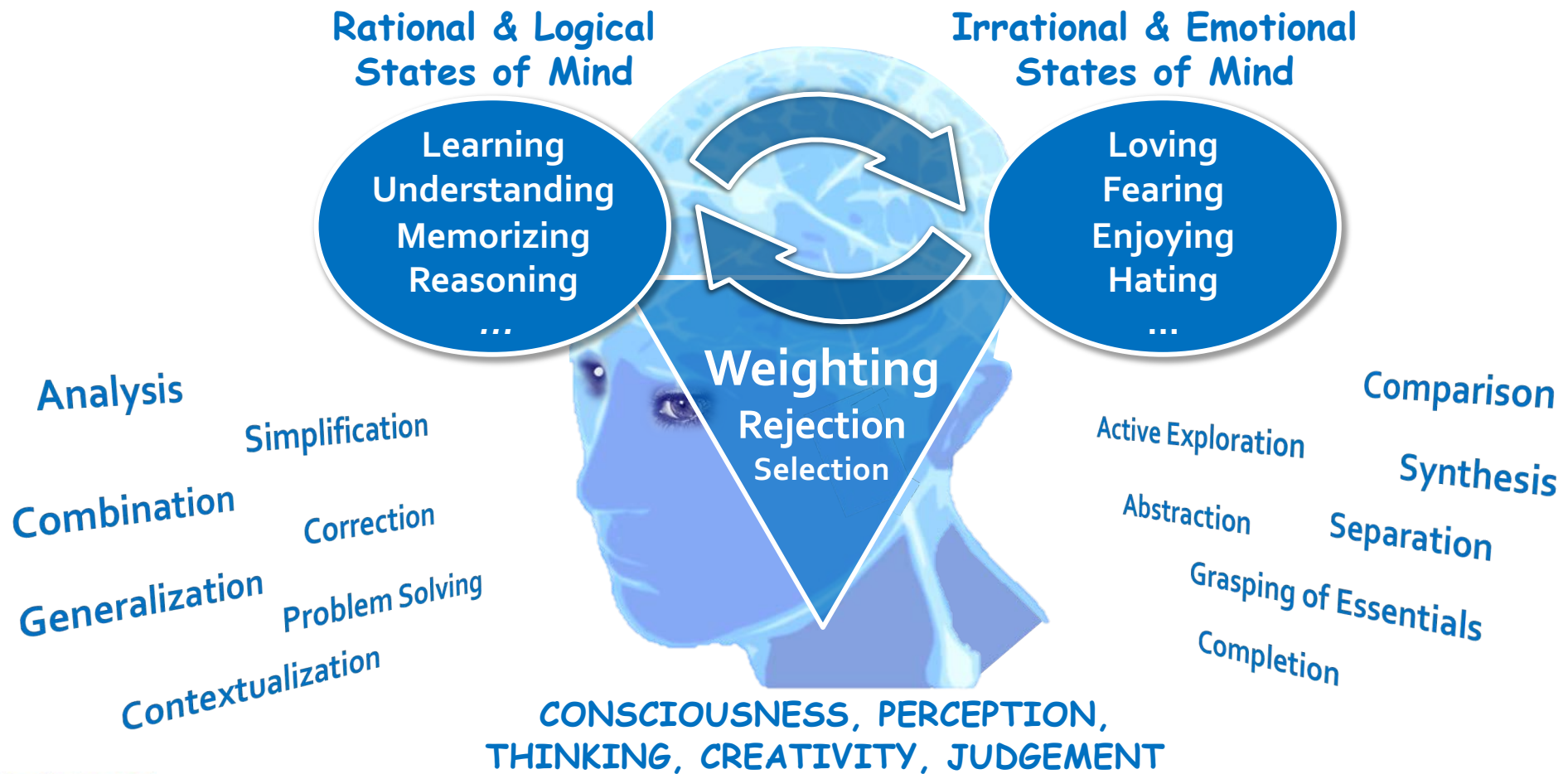


AI as a Means for Intelligence Augmentation and Amplification

Andreas Dengel



Our mind combines various rational and emotional states helping us to “make up our mind”, “keep in mind”, or “change our mind”



Artificial Intelligence (AI) can already be simulated with great success on a computer

Seoul, March 2016



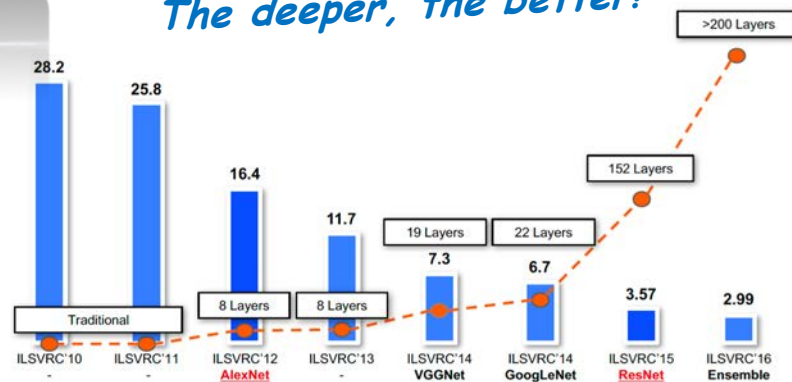
*Google's AlphaGo won
GO-match against
Lee Sedol by 4-1!*



New potential is based on:



- ➡ Availability of big data
- ➡ High computing power
- ➡ Machine (deep) learning

The deeper, the better!




Today, we have access to systems solving intelligence-related problems better than 90 % of human beings




 Übersetzer [Linguee](#) [DeepL Pro](#) [Blog](#) [Info](#) 

Übersetze **Deutsch** (erkannt) ▾

Einen Text ins **englische** zu übersetzen, fällt Systemen wie deepL nicht schwer. Das bedeutet nicht, dass solche Systeme in der Lage sind, den Inhalt oder die Aussage des Textes zu verstehen, **noch diesen auf zu** reflektieren.






 Dokument übersetzen

>

Übersetze nach **Englisch** ▾

Translating a text into English is not difficult for systems like deepL. This does not mean that such systems are able to understand the content or message of the text, nor to reflect on it.

Artificial intelligence is pushing the economy with many potentials and challenges



The revolutionary stage of the AI has given way to an evolutionary stage (especially technologies that learn independently). AI systems ...

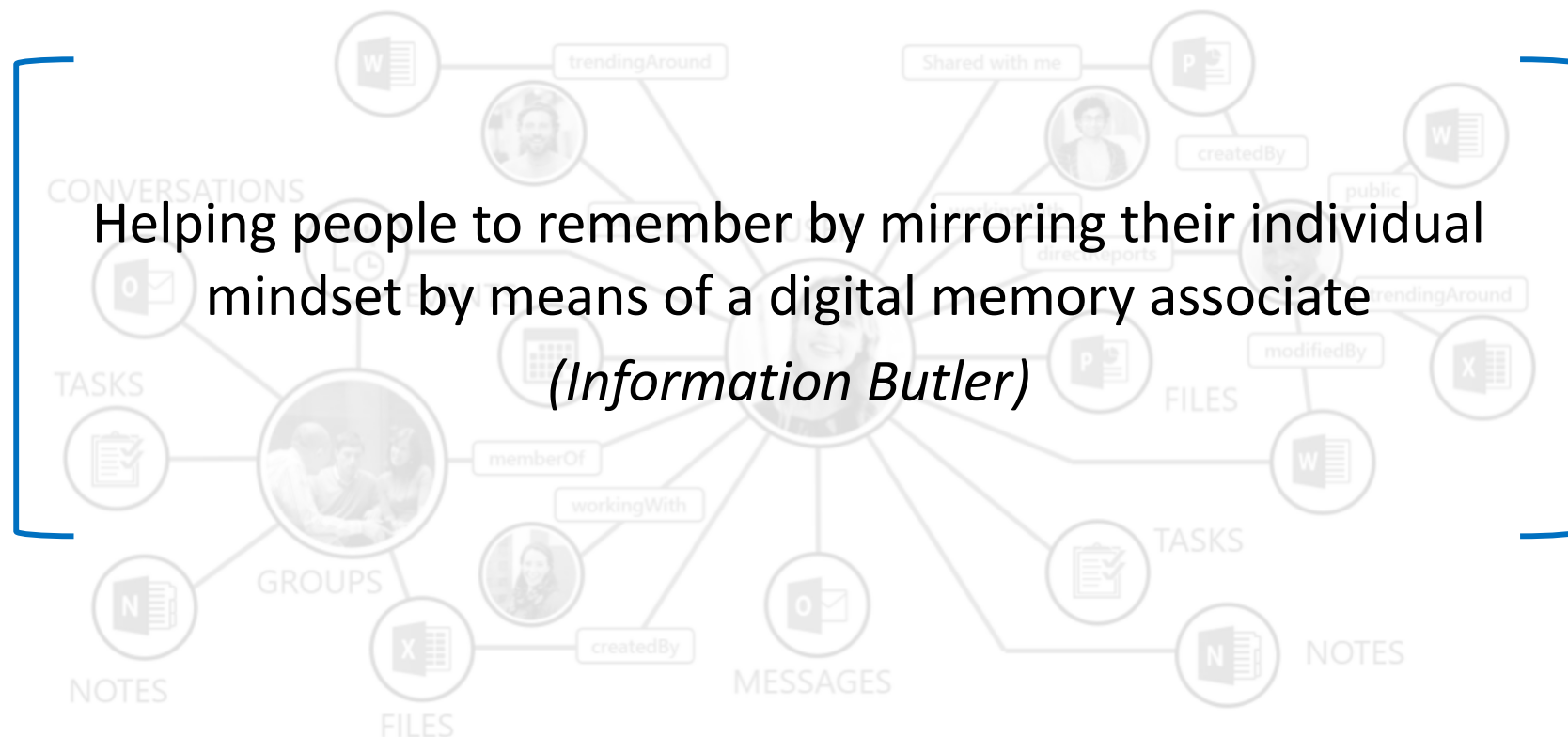
- ... learn complex games without human intervention and become virtually unbeatable
- ... understand linguistic content (whether spoken or written), translate language and conduct dialogues
- ... are able to analyze and evaluate extensive (spatially-temporal) data and reveal correlations or anomalies
- ... can browse social media and understand what moves the world and what people feel about it, recognize and predict trends
- ... can recognize objects, persons and actions in pictures and videos, recognize moods and interpret behavior
- ... know our profiles and can find out what we are looking for and offer us interesting reference information

With all the hype surrounding Artificial Intelligence, we should not lose sight of people

„AI for people!“

„The greatest potential of artificial intelligence is not in the development of human-like machines, but in its ability to act as an intellectual power amplifier in the sense of a digital partner augmenting our mind!“

1



Companies like Google and Microsoft announced to provide their own knowledge graphs



We need digital companions helping us to understand and memorize!

Still today, knowledge workers, like Heiko, have to provide mental bridges between the various information silos



From: heiko.b@dfki.de
Date: 02. July 2015 09:28:11 MEZ
To: tanigalli@imu.portobello-u.it
Subject: Visit at DFKI


Dear Prof. Tanigalli,

Prof. Dengel asked me to send you the agenda for your visit on November 28th.

If you have any question, let me know.

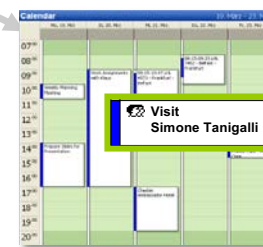
Best regards,
Heiko B.

Heiko B.
Event Management
Deutsches Forschungszentrum
für Künstliche Intelligenz GmbH,
Trippstadter Straße 122
67663 Kaiserslautern
Tel.: +49 631 205 75 1999
Fax: +49 631 205 75 1990
Email: heiko.b@dfki.de

 Agenda.pdf

I have to invite Prof. Tanigalli for our workshop in November!

Calendar



Agenda



Tasks

Task	02-03-15	09-03-15
Write Marketing Report	M D M D F S S	M D M D F S S M D M
Prepare Mngt Summary		
Prepare Visit S. Tanigalli		

Contact Data

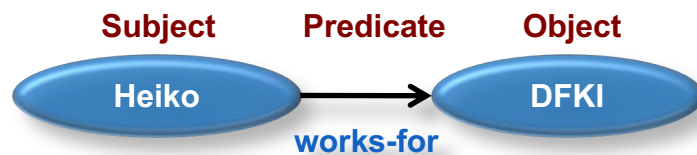
Prof. Dr. Simone Tanigalli



Simone TANIGALLI
Professor
Image and Media Understanding Lab
Portobello University
T +39 ...
F +39-...
E tanigalli@imu.portobello-u.it

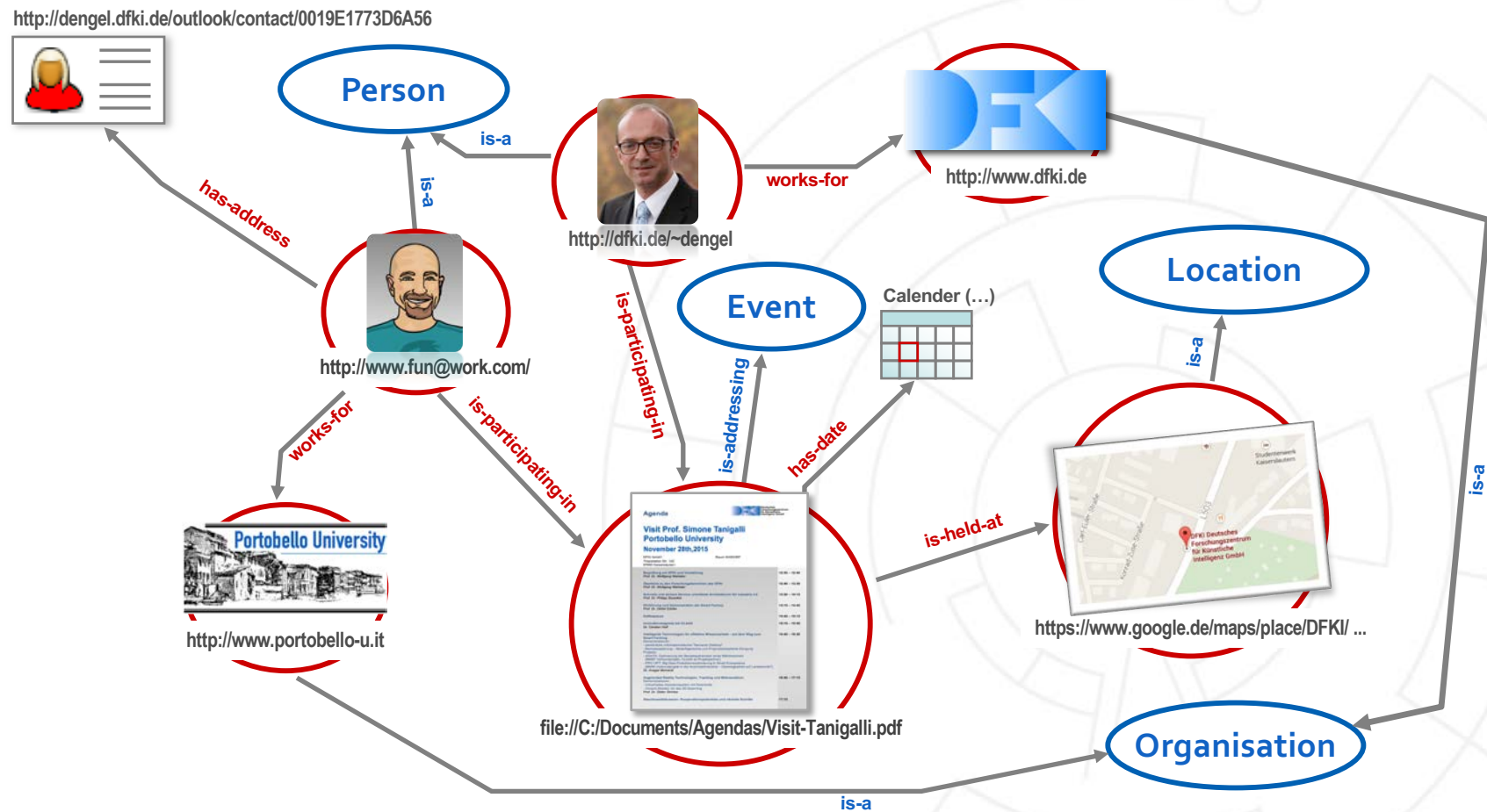


Heiko's Information Butler assists him in remembering the multi-perspective aspects of his work



- Information objects at the workspace are semantically interconnected
- The Information Butler makes use of WWW-Standards for describing meaning by simple sentences (Subject-Predicate-Object)
- The uniqueness of resources is guaranteed by using their URI (Uniform Resource Identifier)
- All information objects (resources) may be categorized according to a class such as Person, Event, Locations, Topics, Tasks or Organization

Based on such a consideration, Heiko establishes a **Personal Information Model (PIMO)**



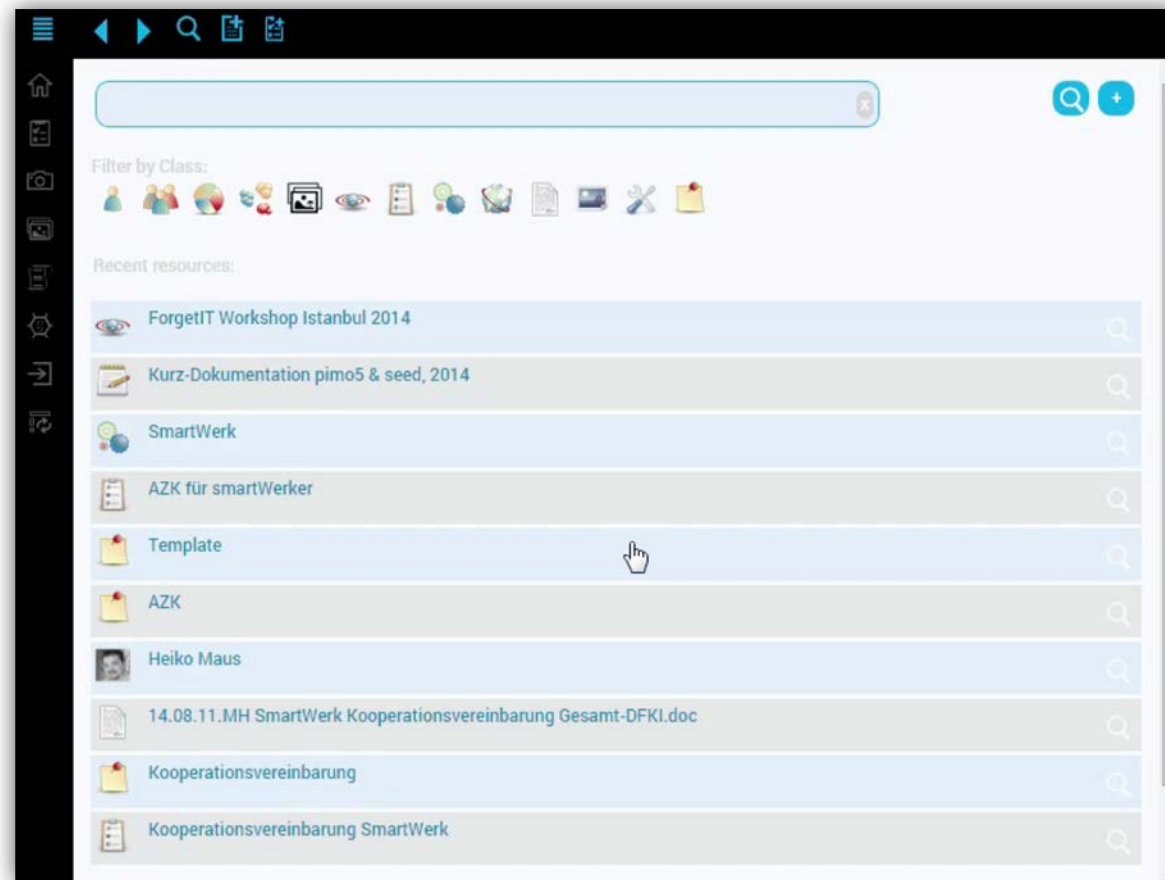


Let's go back to July 29th, 2014



- Besides his many other tasks, Heiko is the coordinator of the EU project ForgetIT
- For that reason he is planning to have a workshop in Istanbul, Turkey on July 30th, 2014
- One day before the workshop he is preparing some topics he intends to talk about

... and is used in daily life (at least within DFKI)





Let's have a closer look to the center of the Linked Open Data Cloud



Central Datasets:

DBpedia

- Extracted from Wikipedia
- 865 M triples



Freebase

- Extracted from Wikipedia
- 3.13 G triples (very many about media)



Wikidata

- New backend for Wikipedia
- 840 M triples



LinkedGeoData

- Extracted from OpenStreetMaps
- 1.01 G triples



The Hummingbird Search developed by Google builds on linked open data coming from Freebase



Freebase

Google

[Alle](#) [News](#) [Bilder](#) [Videos](#) [Maps](#) [Mehr](#) [Einstellungen](#) [Tools](#)

Ungefähr 211.000.000 Ergebnisse (0,41 Sekunden)

Schlagzeilen

[Donald Trump verunglimpft Senatorin als "Pocahontas"](#)
Stern
vor 2 Stunden

Bei Ehrung von Ureinwohnern: Trump bezeichnet Senatorin als... "Pocahontas"
Spiegel Online
vor 5 Stunden

Freihandelsabkommen Trump allein gegen China
Die Zeit
vor 1 Stunde

[→ Mehr zu donald trump](#)

Donald Trump – Wikipedia
https://de.wikipedia.org/wiki/Donald_Trump
Donald John Trump [ˈdɒnəld dʒɒn trʌmp] (* 14. Juni 1946 in Queens, New York) ist der 45. Präsident der Vereinigten Staaten und ein ehemaliger ...
[Persönliches](#) · [Geschäftliches](#) · [Politik](#) · [Positionen](#)

Donald Trump: Der 45. US-Präsident | ZEIT ONLINE - Die Zeit
www.zeit.de · [Politik](#)
Unesco-Ausstieg, Drohungen an Nordkorea, Einreisebeschränkungen – Donald Trump dominiert die Schlagzeilen. Unsere Berichterstattung im Überblick.

Donald J. Trump (@realDonaldTrump) | Twitter
<https://twitter.com/realdonaldtrump> · [Diese Seite übersetzen](#)
36.5K tweets • 2409 photos/videos • 43.5M followers. Check out the latest Tweets from Donald J. Trump (@realDonaldTrump)

Navajo-Ehrung: Donald Trump nennt Elizabeth Warren Pocahontas ...
www.spiegel.de · [Politik](#) · [Ausland](#) · [Donald Trump](#)
vor 6 Stunden - Donald Trump wollte Navajo-Ureinwohner ehren - und nannte dabei eine Kongressabgeordnete "Pocahontas". Die empört sich über eine ...

Donald Trump
45. Präsident der Vereinigten Staaten

Donald John Trump ist der 45. Präsident der Vereinigten Staaten und ein ehemaliger Unternehmer. Er ist der Inhaber des Mischkonzerns Trump Organization und leitete diesen von 1971 bis 2017 als CEO. [Wikipedia](#)

Geboren: 14. Juni 1946 (Alter 71), Jamaica Hospital Medical Center, New York City, New York, Vereinigte Staaten

Größe: 1,88 m

Vermögen: 3,1 Milliarden USD (2017) Forbes

Ehepartnerinnen: Melania Trump (verh. 2005), Maria Maples (verh. 1993–1999), Ivana Trump (verh. 1977–1992)

Kinder: Ivanka Trump, Barron Trump, Tiffany Trump, Eric Trump, Donald Trump Jr.

Wahl: 20. Januar 2017, 20. Januar 2017, 9:00 vorm. GMT-8

Wird auch oft gesucht Über 15 weitere ansehen

Barack Obama

Melania Trump Ehepa...

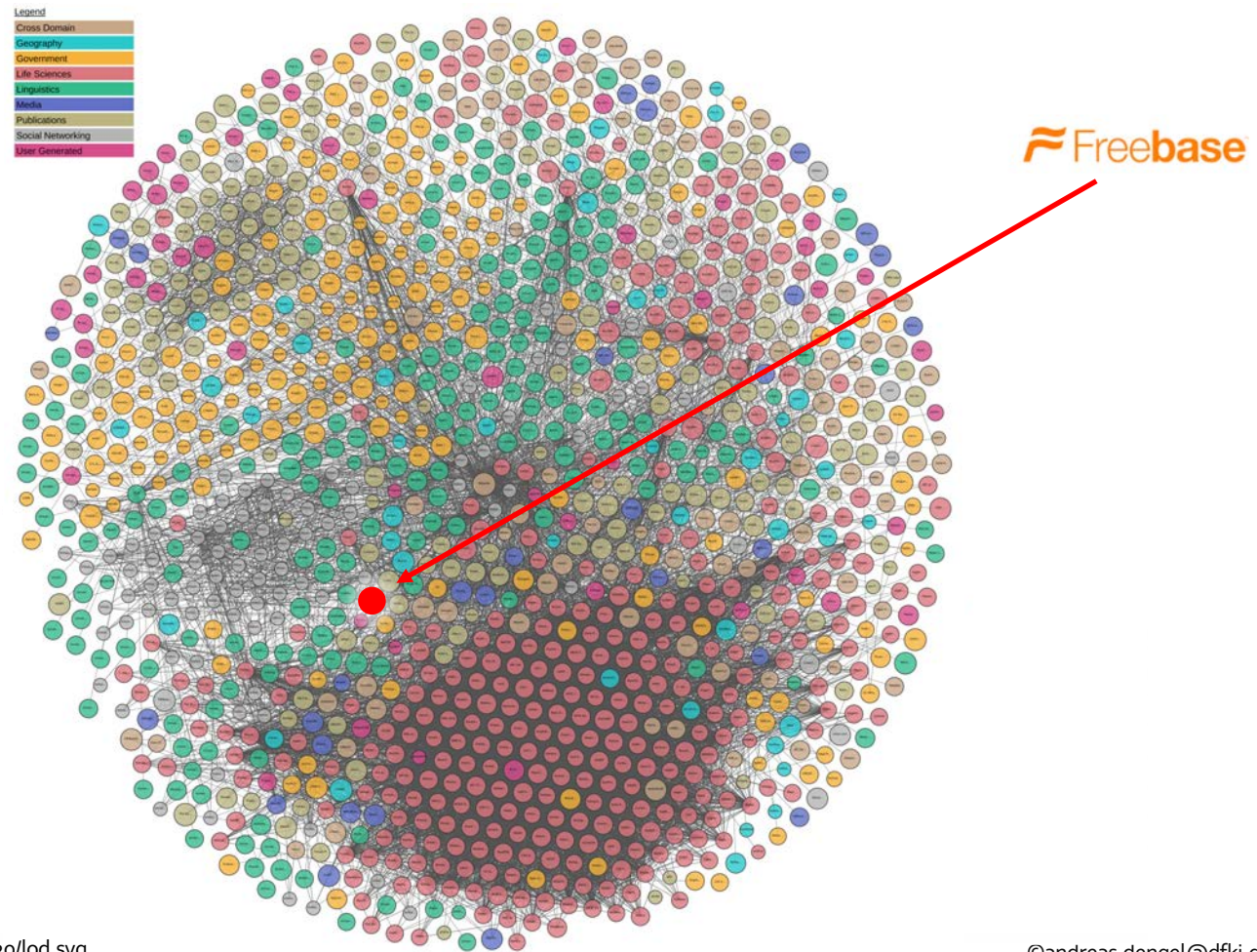
Hillary Clinton

Ivanka Trump Tochter

Wladimir Wiadi... Putin

Let's go back to our example!

A PIMO may be connected to the Linked Open Data Cloud



different settings!



Most important is the fact that we may combine this technology with handwriting recognition on eInk technology



Wacom.com interface showing a handwritten document titled "BSU Annual Partner Conference Meeting". The document content includes:












- Attendees:
 - Markus Weber
 - Dietmar Becker
 - Peter Sommer
- Agenda:
 - Topics
 - Invited Speakers
- Minutes:
 - Introductory topics for partners:
 - o Artificial Intelligence
 - o Signature Verification
 - o Document Analysis
 - Speaker from research
- Action Items:
 - Markus contact Prof. Andreas Dengel?

The interface also shows a sidebar with a calendar for Nov. 05 2018, titled "BSU Annual Partner Conference", and a list of participants: Markus Weber, Dietmar Becker, and Andreas Dengel, each with a checkmark and a document icon. Below the list, there are three items: Artificial Intelligence, Degree, and Artificial Intelligence, each with a green 'G' icon.


Examples are part of collaborative work
between WACOM and DFKI!

Some exemplary publications



-  L. Sauermann, A. Bernardi, and A. Dengel, *Overview and Outlook on the Semantic Desktop*, Proceedings ISWC, 6th International Semantic Web Conference, Galway, Ireland (Nov. 2005), pp. 1-19.
 -  L. Sauermann, G.A. Grimnes, M. Kiesel, C. Fluit, D. Heim, D. Nadeem, B. Horak, and A. Dengel, *Semantic Desktop 2.0: The Gnowsisi Experience*, Proceedings ISWC, 5th Int'l Semantic Web Conference, Athens, GA, USA LNCS 4273, Springer Publ. (Nov. 2006), pp. 887-900.
 -  L. Sauermann, L. v. Elst, and A. Dengel, *PIMO - A Framework for Representing Personal Information Models*, Proceedings I-Media'07 and I-Semantics'07, Graz, Austria (Sep. 2007), pp. 270-277.
-
-  C. Jilek, Y. Runge, C. Niederée, H. Maus, T. Tempel, A. Dengel, and C. Frings, *Managed Forgetting to Support Information Management and Knowledge Work*, Künstliche Intelligenz, Springer Publ. (2018).
 -  M. Schröder, C. Jilek, and A. Dengel, *Deep Linking Desktop Resources*, Proceedings 15th European Semantic Web Conference (ESWC 2018), Heraklion, Crete, Greece (June 2018).
 -  C. Jilek, M. Schröder, S. Schwarz, H. Maus, and A. Dengel, *Context Spaces as the Cornerstone of a Near-Transparent & Self-Reorganizing Semantic Desktop*, Proceedings 15th European Semantic Web Conference (ESWC 2018), Heraklion, Crete, Greece (June 2018), <http://arxiv.org/abs/1805.02181>.
 -  A. Dengel, *Knowledge Technologies for the Social Semantic Desktop*, in: Z. Zhang and J. Siekmann (Eds.): Proceedings KSEM 2007, Int'l Conf. on Knowledge Science, Eng. and Mgmt., LNAI 4798, Springer Publ. (Nov. 2007), pp. 2-9
 -  M. Schröder, C. Jilek, J. Hees, S. Hertling, and A. Dengel, *RDF Spreadsheets Editor: Get (G)rid of Your RDF Data Entry Problems*, Proceedings 16th Int'l Semantic Web Conference (ISWC 2017), Vienna, Austria, (Oct. 2017).
 -  S. Hertling, M. Schröder, C. Jilek, and A. Dengel, *Where is that button again?! - Towards a universal GUI Search Engine*, Proceedings ICAART-17, 9th Int'l Conference on Agents and Artificial Intelligence, Porto, Portugal (Jan. 2017) .
 -  C. Jilek, S. Schwarz, H. Maus, and A. Dengel, *Managed Forgetting, Data Condensation & Preservation in Application*, Proceedings WAHM'16, 3rd Int'l Workshop on Augmenting Human Mind, Heidelberg, Germany (Sept 2016).
 -  C. Jilek, H. Maus, S. Schwarz, and A. Dengel, *Diary Generation from Personal Information Models to support Contextual Remembering and Reminiscence*, Proceedings HMMP'15, Workshop on Human Memory-Inspired Multimedia Organization and Preservation, IEEE Int'l Conference on Multimedia and Expo Workshops, Torino, Italy (July 2015), doi: 10.1109/ICMEW.2015.7169753, pp. 1-6.

2



Understanding what the world is talking about
but also how people feel about it
(*Multimedia Opinion Mining*)

We are not talking about a fact but rather about a subjective but not conclusive statement, i.e. a judgment, a viewpoint, or an emotion



Globalization led to a more diverse but intensive communication that increasingly moves the people

Coca-cola factory leaks diesel to a river in Sri Lanka:
Contaminating the drinking water source for millions of Sri
Lankans.



10,641 points · 496 comments

@tintin1957: #Syria CONFESSION #Assad's Shabiha
said: I love to wear my Adidas pant when i'm beating
prisoner <http://t.co/cuqRZi1x> #Obama #USA



18+ Syria - Assad Soldiers Abuse Detainees 6-27-12 Human Rights Abus...



Syria2012Archives · 711 videos

Subscribe 1,574

1,814

Like

About

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Add to

Like

Dislike

Published on Jun 27, 2012

18+ Adults Only - Warning - Contains Graphic Images - Not for Shock - Documentary Evidence of Crimes Against Humanity Committed by Syria Dictator Bashar Assad as he orders his Army and Security Forces to Arrest, Torture and Kill thousands of innocent unarmed pro Democracy Protesters all across Syria -



Chris Kluwe @ChrisWarcraft · 3h

Unrestrained capitalism is the best. Never leads to any problems. None whatsoever. theguardian.com/business/2015/...



VW scandal caused nearly 1m tonnes of extra pollution, analysis shows
Emissions could have far greater impact in Europe, where almost half passenger cars are diesel, than the US
theguardian.com

RETWEETS
48

FAVORITES
79



9:10 PM - 22 Sep 2015 · Details

[Hide summary](#)



@ChildLaborCLC · Jan 18

[PHOTOS] The Child Miners of #Bolivia: bit.ly/1zb2rE5

#ChildMiner #ChildLabor pic.twitter.com/ggQ00AbmaJ

Social Media – the idea and the outcome



NYPD NEWS
@NYPDnews

Do you have a photo w/ a me
#myNYPD. It may be feature

10:55 AM - 22 Apr 2014

426 RETWEETS 219 FAVORITES



Occupy Wall Street
@OccupyWallStNYC

Follow

Here the #NYPD engages with its community members, changing
hearts and minds one baton at a time. #myNYPD

12:12 PM - 22 Apr 2014

1,415 RETWEETS 533 FAVORITES



al gag
@amusem

Follow


@nypdnews Is that the one your public relations people requested?
#mynypd

1:12 PM - 22 Apr 2014

36 RETWEETS 11 FAVORITES



Ads placement – the idea and the outcome




00:21 / 01:01

SAVE \$5
on new PEDIGREE.
Exclusive savings for Kroger shoppers.

[FETCH COUPON >](#)

Like Add to Share

Uploaded by [EzekielSOA](#) on Sep 16, 2011
no description available
Category: Tags:
Howto & Style IMG 0988



00:21 / 01:01 360p

SAVE \$5
on new PEDIGREE.
Exclusive savings for Kroger shoppers.

[FETCH COUPON >](#)

Like Add to Share 52 views

Uploaded by [EzekielSOA](#) on Sep 16, 2011
no description available
Category: Tags:
Howto & Style IMG 0988

“scary dog”



00:21 / 01:01 360p

SAVE \$5
on new PEDIGREE.
Exclusive savings for Kroger shoppers.

[FETCH COUPON >](#)

Like Add to Share 52 views

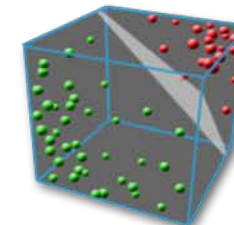
Uploaded by [EzekielSOA](#) on Sep 16, 2011
no description available
Category: Tags:
Howto & Style IMG 0988

“cute dog”

We implemented a visual sentiment analysis approach trying to understand emotional concepts in images



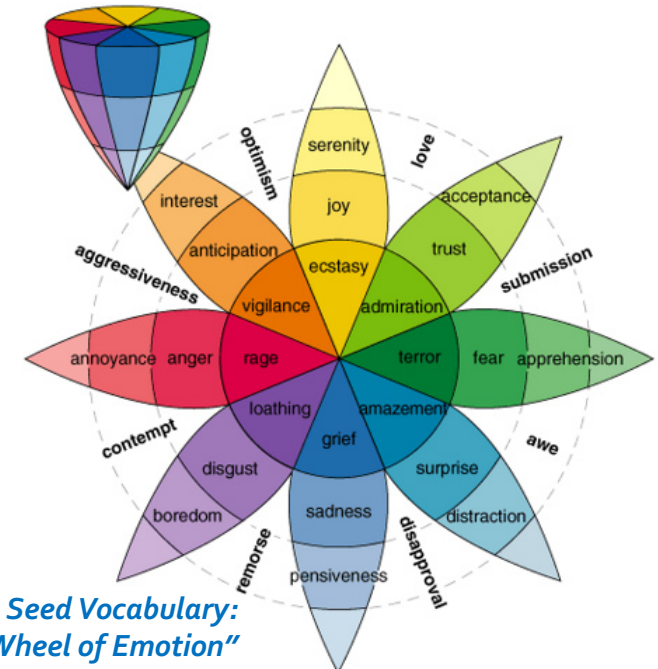
Visual Sentiment Ontology



Evil Robot
Scary Dog
Heavy Snow
Lovely Smile
Broken Wings
Dirty Shoes
Nice Beach
Sweet Cake
Beautiful Sunset
Cute Baby
Great View
Cold Winter
Beautiful Sunset
Haunted House
Cold Drink
Young Beauty
Abandoned Building
Amazing Car
Sad Eyes









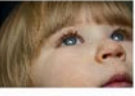


Training a Deep Convolutional Network employing the Yahoo Flickr Creative Common 100 Million

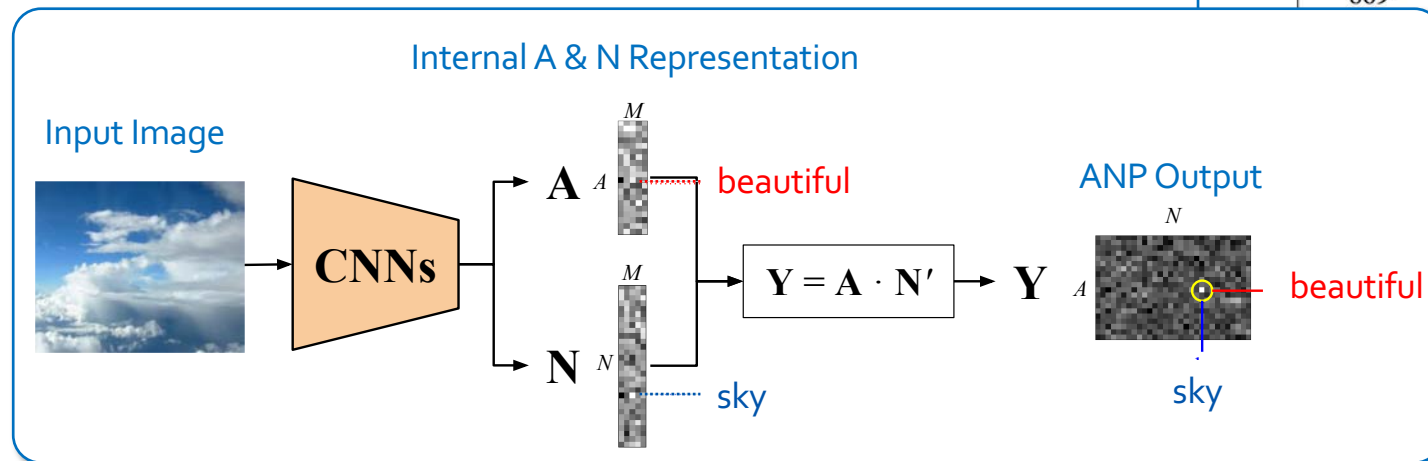


For training Adjective-Noun-Pairs (ANPs) we employed novel deep learning architectures

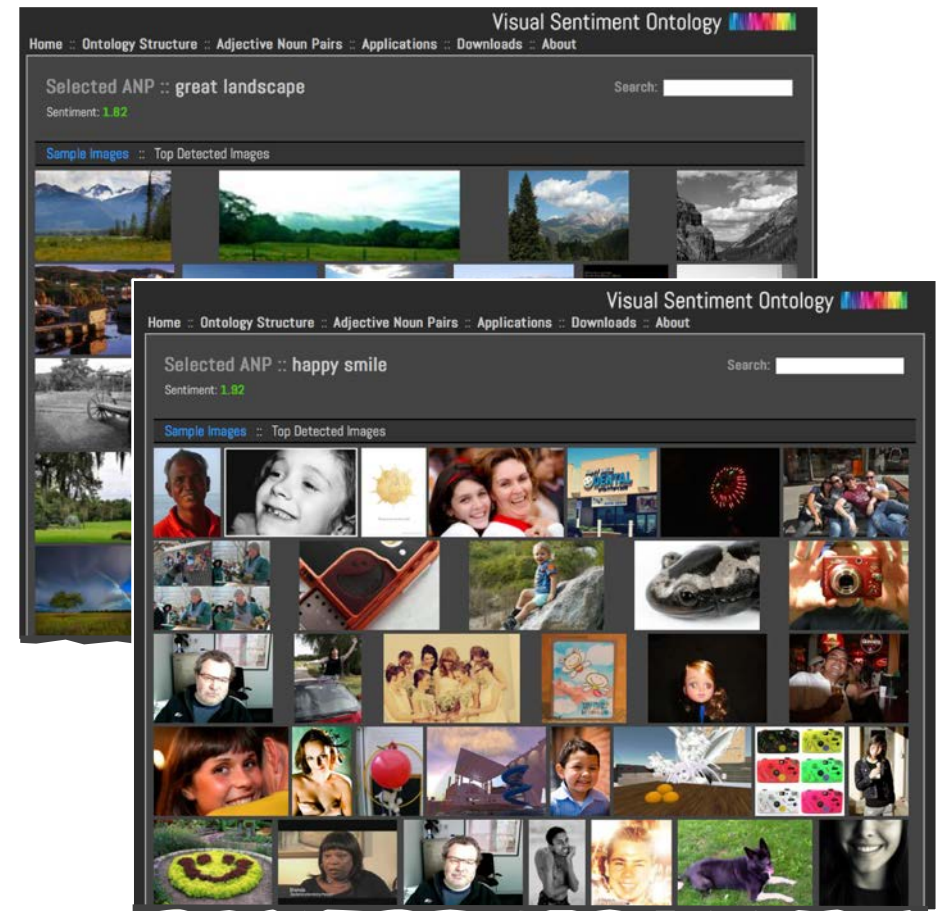


- ⇒ We used a factorized Neural Network built upon VGG
- ⇒ The network is trained separately for adjectives and nouns with a split at the fully connected layers
- ⇒ Consequently unseen ANPs can be classified

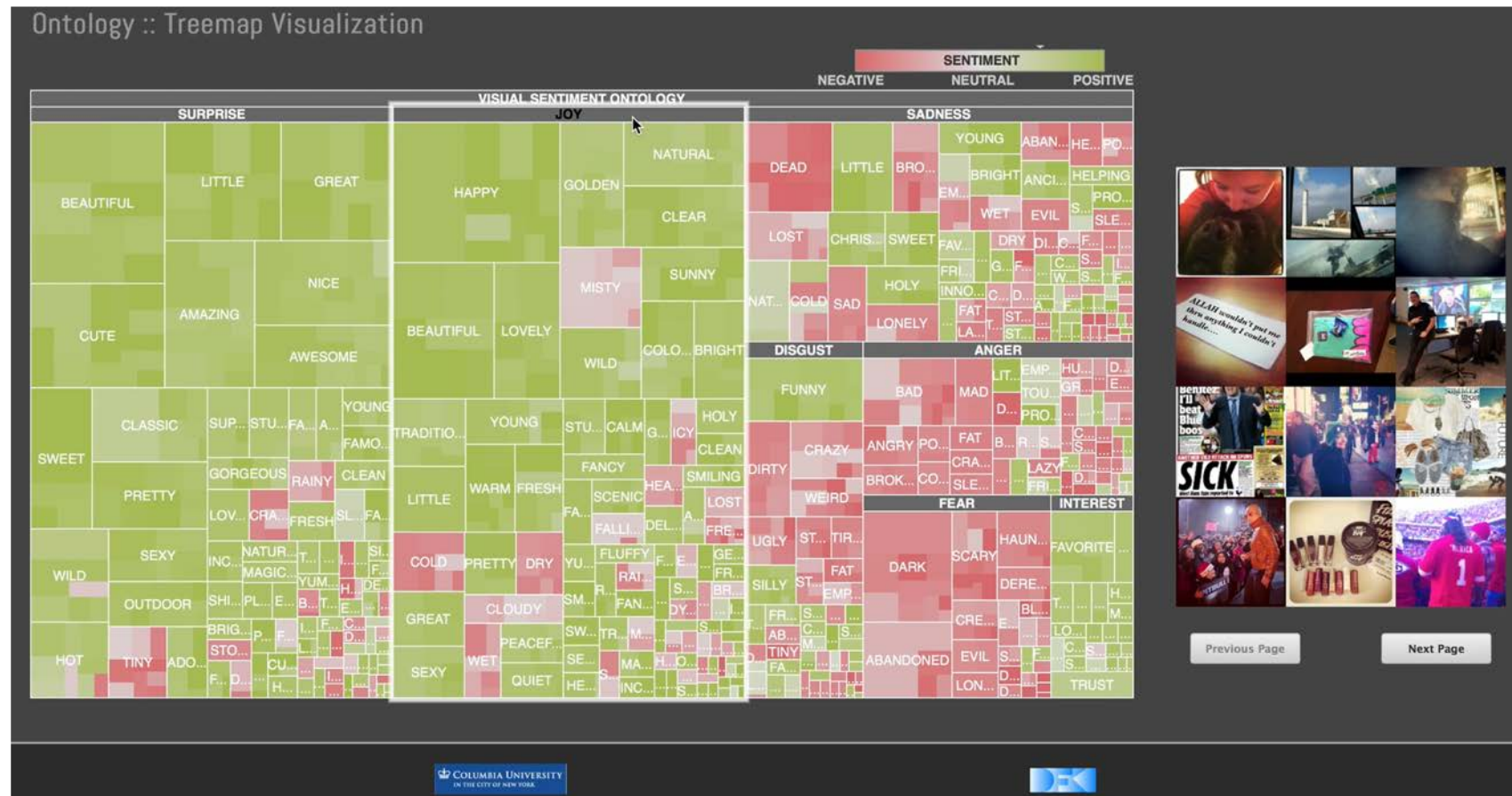
Adj- ective	Noun			
	girls	baby	face	eyes
adorable	 489	 514	 420	0
pretty	 869	 336	 487	 703
	0		 430	 94




As result, our network learned more than 2,000 emotional concepts associated to pictures and videos*



We may also browse through the entire ontology using a tree map









In the various visual concept, we were able to identify different aspects of emotion

Visual Sentiment Ontology 

Home :: Ontology Structure :: Adjective Noun Pairs :: Applications :: Downloads :: About

Adjective Noun Pairs :: Sorted List Search:

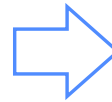
Adjectives: Nouns: Emotions: ☒ filter detectable ◀ 1 of 1 [total: 4 ANPs] ▶

Name	Sentiment	Images	AvgP	Sample Visualization	Average Image	Top Emotions
▶ beautiful landscape	1.82	849,000	0.6			1. amazement 2. serenity 3. interest 4. joy 5. sadness 6. pensiveness
▶ great landscape	1.82	156,000	0.36			1. amazement 2. serenity 3. interest 4. sadness 5. joy 6. boredom
▶ colorful landscape	1.82	46,500	0.42			1. serenity 2. amazement 3. interest 4. joy 5. sadness 6. admiration

Factorized Neural Nets classifies Adjective-Noun-Pairs and simulates of the subjective perception of humans



Deep CNNs
(Deep Learning)



1. little church
2. ancient house
3. damaged church
4. ancient bridge
5. ancient church



Deep CNNs
(Deep Learning)



1. stormy mountain
2. stormy coast
3. stormy waves
4. misty hills
5. stormy clouds

<https://deepsentibank.appspot.com>

However, the impression of image content is different and may lead to alternative interpretations

HOLISTIC



"Beautiful Landscape"

LOCALIZED



"Cute Baby"

SUBJECTIVE

OBJECTIVE



"Stormy Landscape"

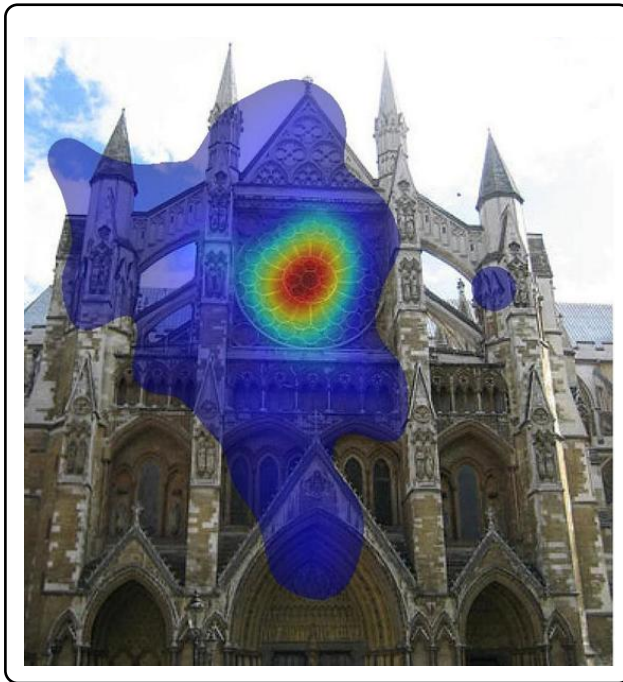


"Damaged Building"

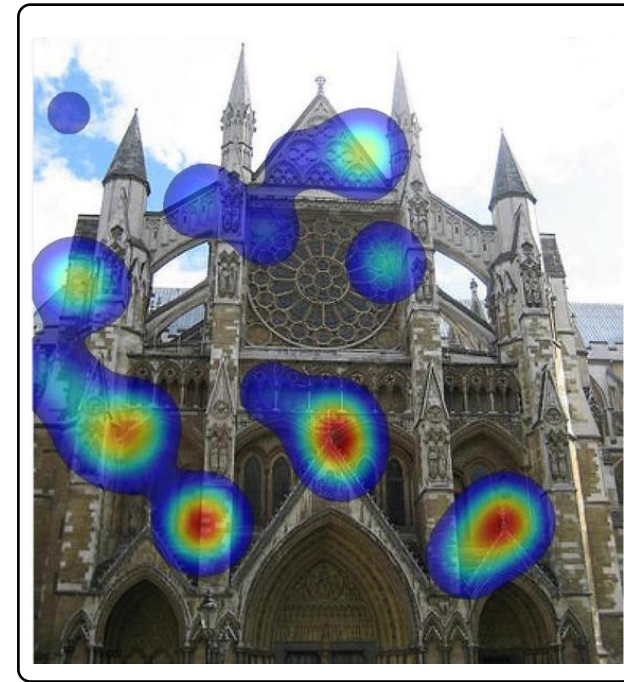
When assessing ANP images differently, people show different attention pattern

Original ANP: "Gorgeous Building"

Do you agree?



Yes Assessment



No Assessment

Trained neural networks simulate the subjective perception of image content ...

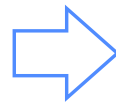
flickr

user tag

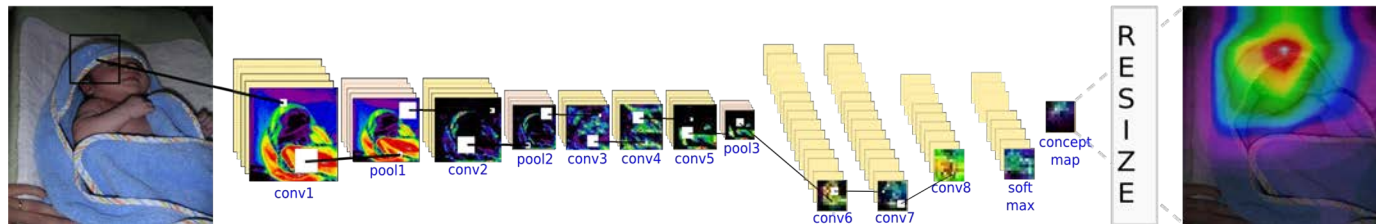
"stormy landscape"



Deep CNNs
(Deep Learning)



1. stormy mountain
2. stormy coast
3. stormy waves
4. misty hills
5. stormy clouds



... but also allow to
localize sentiment
concepts



stormy waves

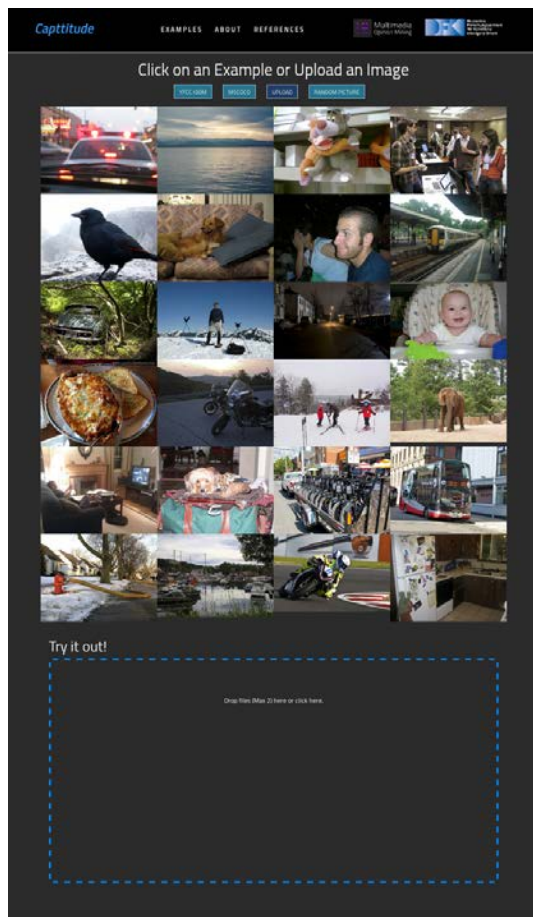


stormy coast



stormy clouds

Thus, we may provide an interface for *Affective Image Captioning*



"Stunning
Architecture in
busy city"



"Hot guy with pensive
face and nice hat"














"Cheerful flower with
outstanding beauty in
fantastic nature"

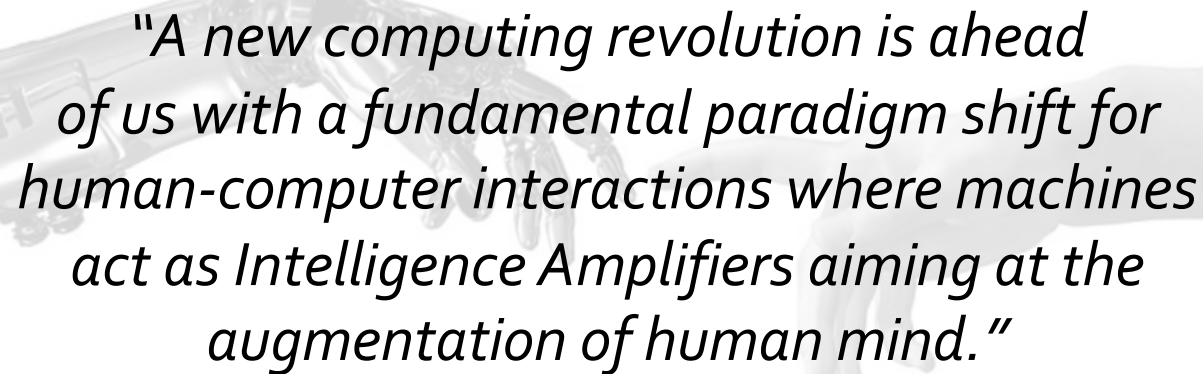


Some exemplary publications



-  P. Blandfort, T. Karayil, D. Borth, and A. Dengel. *Captioning in the wild: How people caption images on Flickr*. ACM Workshop on Multimodal Understanding of Social, Affective and Subjective Attributes (2017).
-  S. Palacio, J. Folz, A. Dengel, J. Hees, and F. Raue, *What do Deep Learning Networks like to see?*, Proceedings CVPR 2018, Int'l Conference on Computer Vision and Pattern Recognition, Salt Lake City, Utah, USA (June 2018), <http://arxiv.org/abs/1803.08337>, NVIDIA Pioneer Award
-  T. Karayil, Ph. Blandfort, J. Hees, and A. Dengel, *The Focus-Aspect-Polarity Model for Predicting Subjective Noun Attributes in Images*, <http://arxiv.org/abs/1810.06219>.
-  P. Blandfort, T. Karayil, D. Borth, and A. Dengel, *Introducing Concept And Syntax Transition Networks for Image Captioning*, Proceedings ICMR 2016, 34th ACM Int'l Conference in Multimedia Retrieval, New York, USA (June 2016) pp. 235-388.
-  A. Koochali, S. Kalkowski, A. Dengel, D. Borth, and C. Schulze, *Which languages do people speak on Flickr? A Language and Geo-Location Study of the YFCC100m Dataset*, Proceedings ACM Multimedia 2016 Workshop: MMCOMMONS, Amsterdam, Netherland (Oct. 2016), accepted for publication.
-  T. Karayil, P. Blandfort, D. Borth, and A. Dengel, *Generating Affective Captions with Emotions using Concept and Syntax Transition Network*, Proceedings 2016 ACM Multimedia Conference Symbolic Association, Amsterdam, Netherland (Oct. 2016), pp. 1111-1115.
-  B. Thomee, D. A Shamma, G. Friedland, B. Elizalde, K. Ni, D. Poland, D. Borth, and L.-J. Li. The New Data in Multimedia Research. *Communication of ACM*, 2016.
-  S. Elkasrawi, H. Elwy, S. Baumann, C. Reuschling, and A. Dengel, *Trendradar: Extraction and Prediction of Social Trends*, Proc. ICDM 2016, 16th Industrial Conf. on Data Mining, New York, USA (July 2016).
-  S. Kalkowski, C. Schulze, A. Dengel, and D. Borth. Real-time Analysis and Visualization of the YFCC100m Dataset. In *ACM Multimedia MMCOMMONS Workshop*, 2015.
-  J. Folz, C. Schulze, D. Borth, and A. Dengel. Aesthetic Photo Enhancement using Machine Learning and Case-Based Reasoning. In *ACM Workshop on Affect and Sentiment in Multimedia (ASM)*, 2015.
-  B. Thomee, D. Shamma, G. Friedland, B. Elizalde, K. Ni, D. Poland, D. Borth, L.-J. Li, *YFCC100m: The New Date in Multimedia Research*, Communication of the ACM, 2016

Take-Away



"A new computing revolution is ahead of us with a fundamental paradigm shift for human-computer interactions where machines act as Intelligence Amplifiers aiming at the augmentation of human mind."

Thank You!



Address:

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P.O. Box 2080

D-67608 Kaiserslautern

email: andreas.dengel@dfki.de

<http://www.dfki.de/~dengel>

