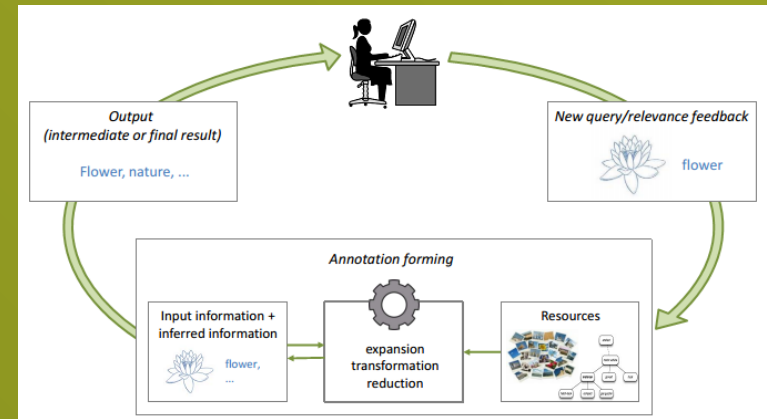# Annotation Framework & ImageCLEF 2014
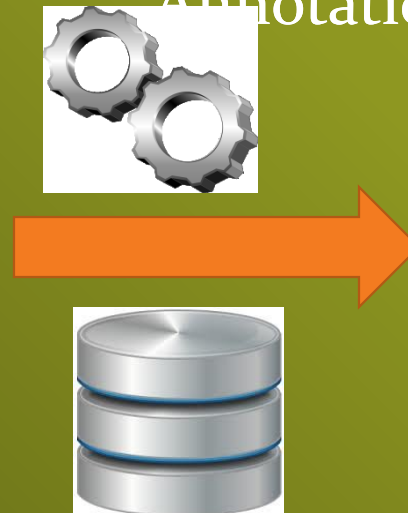
JAN BOTOREK, PETRA BUDÍKOVÁ

10. 3. 2014

Annotation Tool

- WordNet
- Visual Concept Ontology
- MUFIN visual object search

Annotation tool + MUFIN

- House
- Nature
- Forest
- Tree

...

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Profimedia

What is ImageCLEF

- Competition regarding cross-language annotation and retrieval of images

- Different areas of interest:

  - Robot vision – object recognition

  - Plant identification

  - Medical image identification

  - **Concept Image Annotation**

    - Goal: From a given set of concepts, select those that are relevant for an input image

Concept Image Annotation in 2014

- Focus on scalability – no manually labeled training data

- Noisy training data downloaded from internet are only available

- Development data – 10000 images with ground truth concepts

- Participants are allowed to use no manually labeled training data that was created directly for machine learning

  - Profiset is OK, since it is a by-product of another activity (image selling)

CLEF Annotation Task vs. our annotation tools

- **Our long-time research objective**: general image annotation without well-labeled training data

  - „Big Data approach"

  - Primarily focused on description of noun objects

  - Difficult to evaluate

- CLEF: Annotation contest with ground truth

  - Considers nouns, adjectives and verbs

  - Participants typically use model-based approaches

Competition's benefits for us

- Evaluation of our tools on a well-known ground truth
  - Images of numerous types and situations are included in the CLEF collection as a training and development material.

- Compare our ideas to solution with other teams

- Utilize our current approach to the image annotation process in the practice
  - With a feedback from the initiators

- Long-time objective: journal paper about search-based annotation, CLEF results as part of evaluation

What we plan to utilize?

- WordNet-based relations

  - Must be accustomed to the given word types (not just nouns)

- WordNet-based word similarity metrics

- Visual Concept Ontology

- Similar Images search – powered by MUFIN

- **Co-occurrence relations among words within Profimedia dataset**

  - Constructed by **Institute of Formal and Applied Linguistics (MFF UK)**

WordNet vs. co-occurence

- **WordNet** – fundamental technology
  - Meanings, relations, multiple word types
  - Hypernymy, antonymy, part-whole, gloss...
  - "language" point of view

- **Co-occurrence** table of related words
  - Constructed from very large text corpora (linguists from MFF UK)
  - For each word that occurrs in Profiset descriptions, we have 100 most *co-occurred* words
    - No word types attached
  - "human/database" point of view

Our approach I. Overall View

Our approach II. Network example

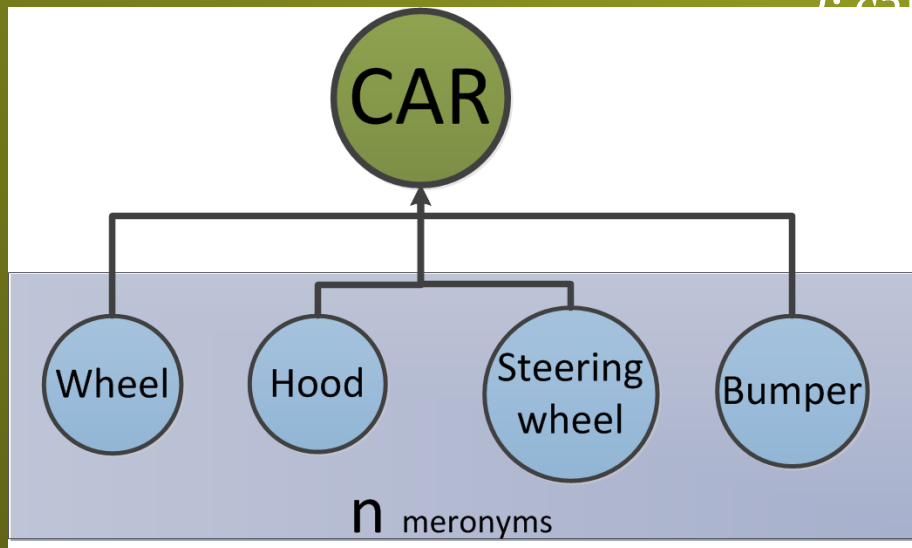- distribute probabilities – **PageRank style**
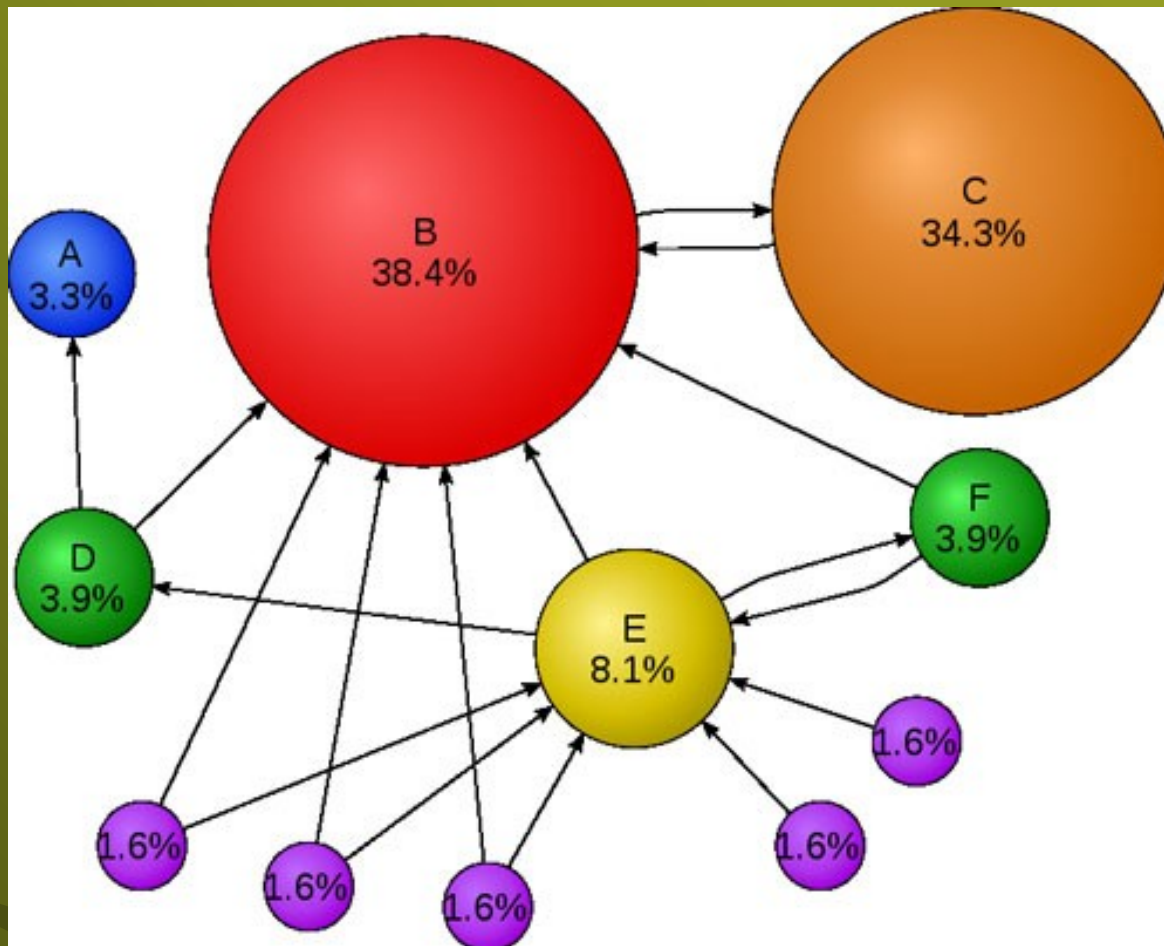
Our approach III.
The probability-transfer network

- The probability-transfer coefficients of links between individual nodes are defined for different types of relations: hypernymy, synonymy, meronymy, word co-occurrence, …

- E.g. Meronyms (whole -> parts): $(1-l)/n$

    l: calibration constant

Our approach IV. Algorithm steps

1) Assign probability values to initial nodes

2) Build the network

- Extend initial nodes by related **synsets** AND **co-occurred words**

- Assign "probability-transfer coefficients" to links between nodes (determined by the type of relationship)

3) "Page-ranking" process

- Run a process where synsets will mutually boost one another's probability values

4) Select the most probable synsets

Our approach V: Network example
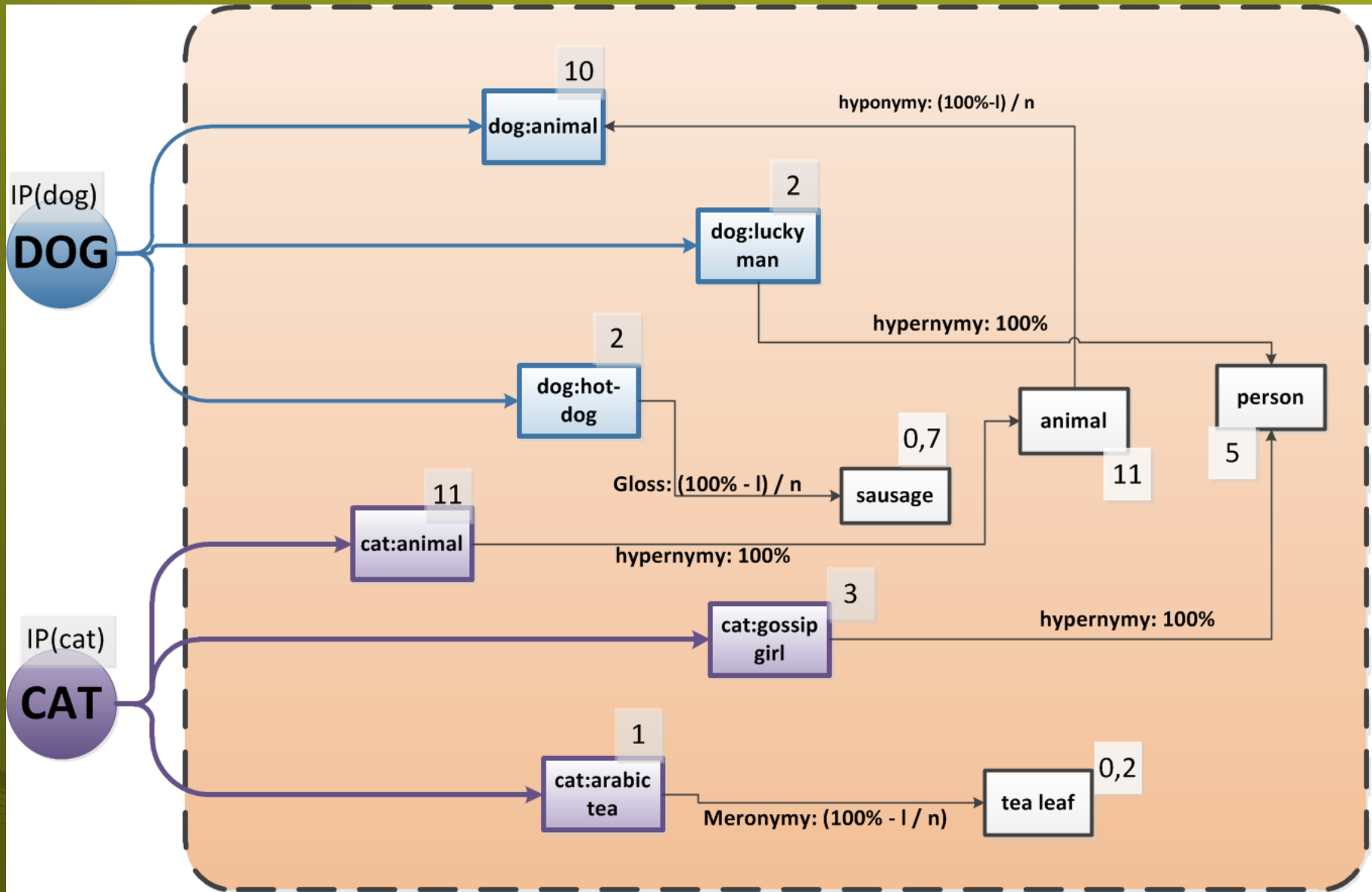
Our approach VI. Unresolved issues

- Calibration of probability-transfer coefficients
  - What constants should be used?

- Initial step: assignment of initial probabilities for particular annotation words

- Details of the probability transfer algorithm

- Final step: Selecting of the most probable concepts

Summary

- Problem
  - Select descriptive words of given image from a predefined set of concept words

- Our approach
  - Construction of a network of synsets; a node (synset) influences another's probability by mutual relations
    - Inspired by page-ranking algorithm

- Main research objectives
  - Design and construct a model of the synset network
  - Define and calibrate relations (links) among nodes in the network (synsets)