Iconizer:
A Framework to Identify and Create Effective Representations for Visual Information Encoding

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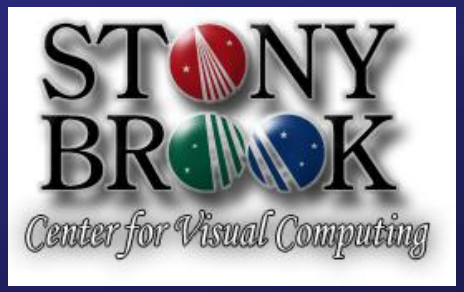

Previous Works

Icon algebra [Kovalerchuk et al.]

- visual language

Semanticons [Setlur et al.]

- create file icons by abstracting terms occurring in the file name

Photo collages [Rother et al.]

- automatic creation of collages from image collections

Photo Clip Art [Lalonde et al.]

- insert photo-realistic objects into new images

Annotate text with 3D renderings [Coyne et al , Götze et al., Götzelmann et al.]

- example: Word-Eye

Story-Picturing-Engine [Joshi et al.]

- index image search engines with exact lexical terms in the text
- no semantic interpretation, integration, or visual abstraction

The Power of Visual Representations

Visualization is an efficient way to communicate information

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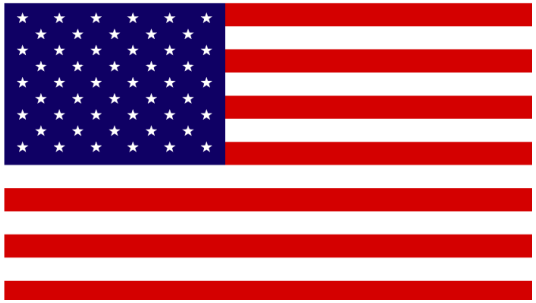
Pictograms can tell a story by composition

Should be simple and universally understood

Types of Icons: Symbols

Must be learned



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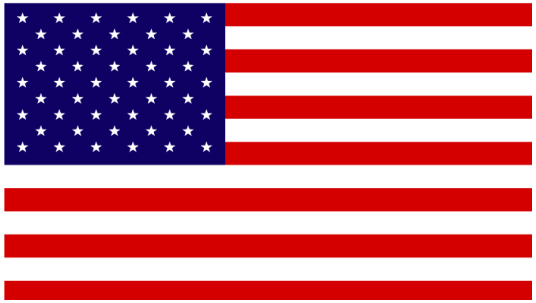

Different emotions/feelings may be associated with these

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May elicit different responses

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How to find that dominant set of attributes?

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- in some ways represents a huge user study
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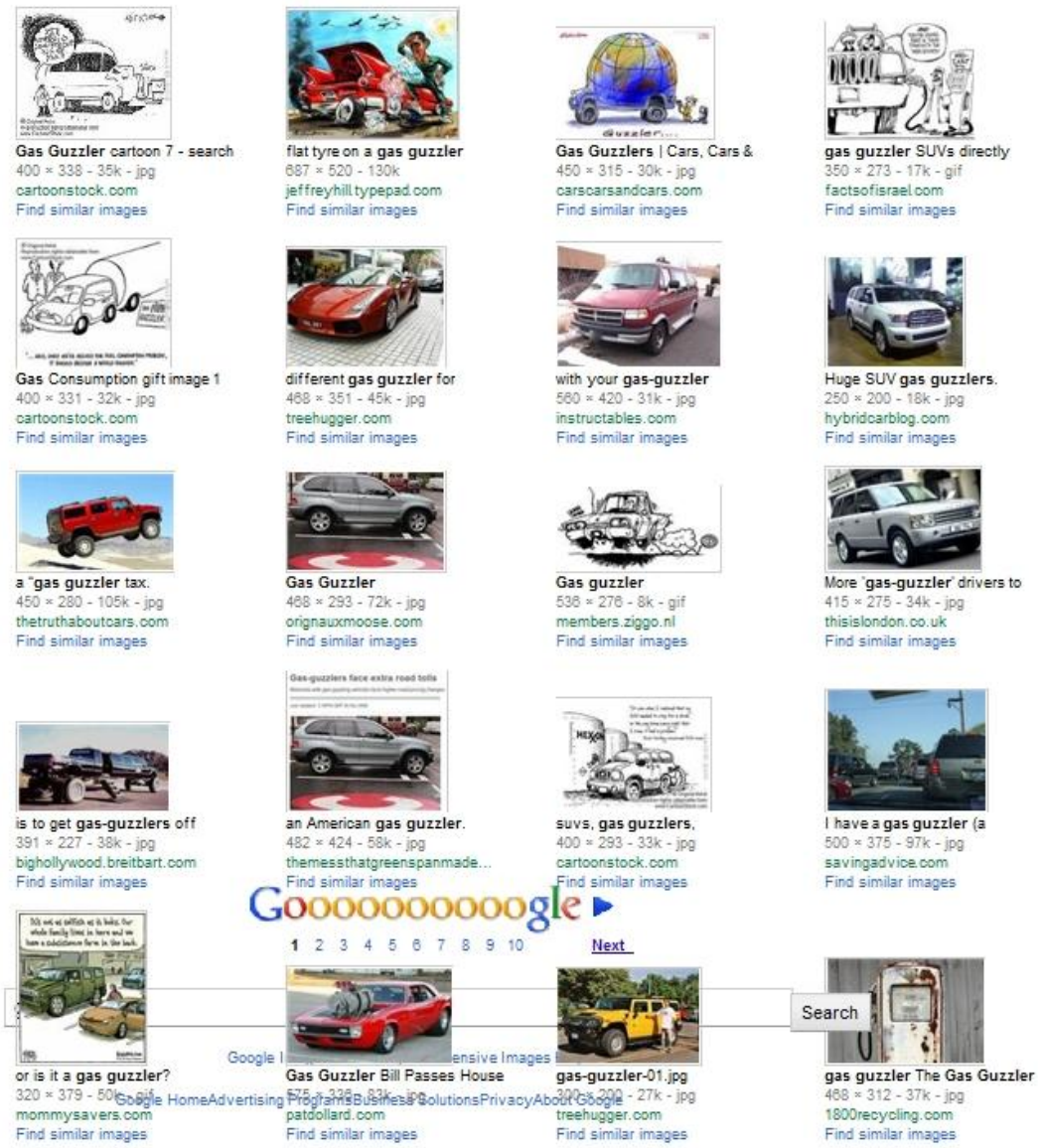
Problems with this approach

- lots of unwanted images (polysemy)

  → content-based image retrieval (CBIR) is largely an unsolved problem
- so it will not be that easy
- in fact, finding good visual representations for concepts is a 'commonsense' problem
- so is there any hope?

Types of Image Polysemy (1)

'Gas Guzzler'



Types of Image Polysemy (2)

'Travel'

TRAVEL AGENTS
740 x 380 - 38k - jpg
grecotel.com

travel
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clv.com.au

Adventure **travel** is
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- Lexical Freenet, Wordnet, Basic English, …
- encode the semantics better than CBIR (at least so far)
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Introduce the idea of *Iconicity Bridge (I-Bridge)*

- uses textual commonsense to move the concept closer to something tangible for which a good icon can be found
  → object, substance, container, person, or some visual action

Iconicity Bridge (I-Bridge)

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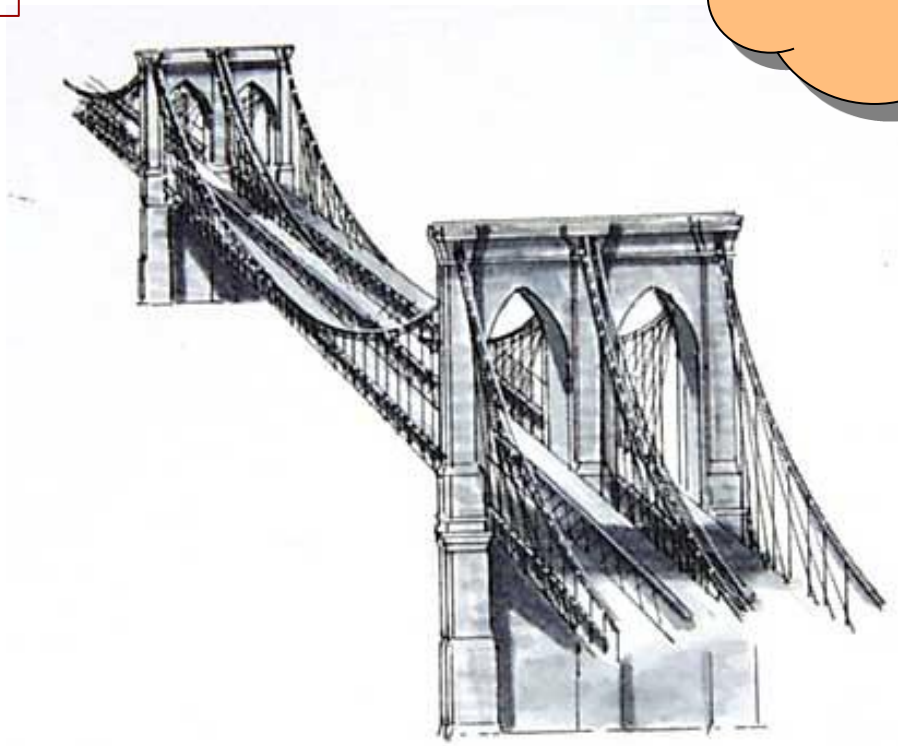
Space of Concepts

Travel



Suitcase

Compare: Travel …

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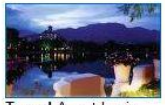
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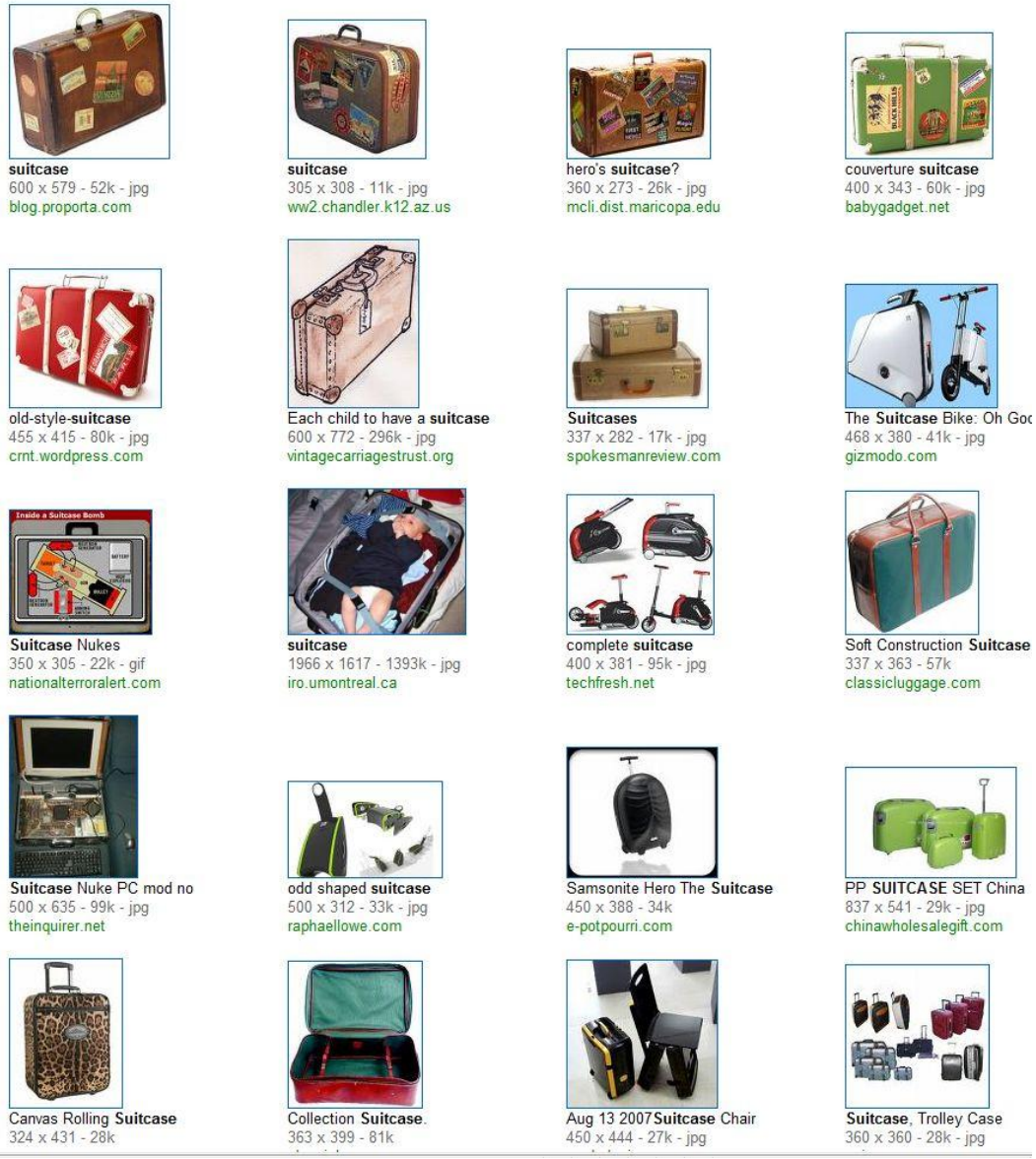

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Links in textual databases

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Test resulting images with majority clustering

- co-cluster with textual terms
- consensus yields one or more prominent image clusters
- pick the center of the largest cluster
  → icon

Clustering: Some More Detail

We focus mainly on shapes

- determine edges using Canny edge detector

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Both yield a high-dimensional feature vector per image

- cluster these vectors via affinity clustering

Icons as the Cluster Center

The best representation is the cluster center

- it can also be thought of as the average visual encoding

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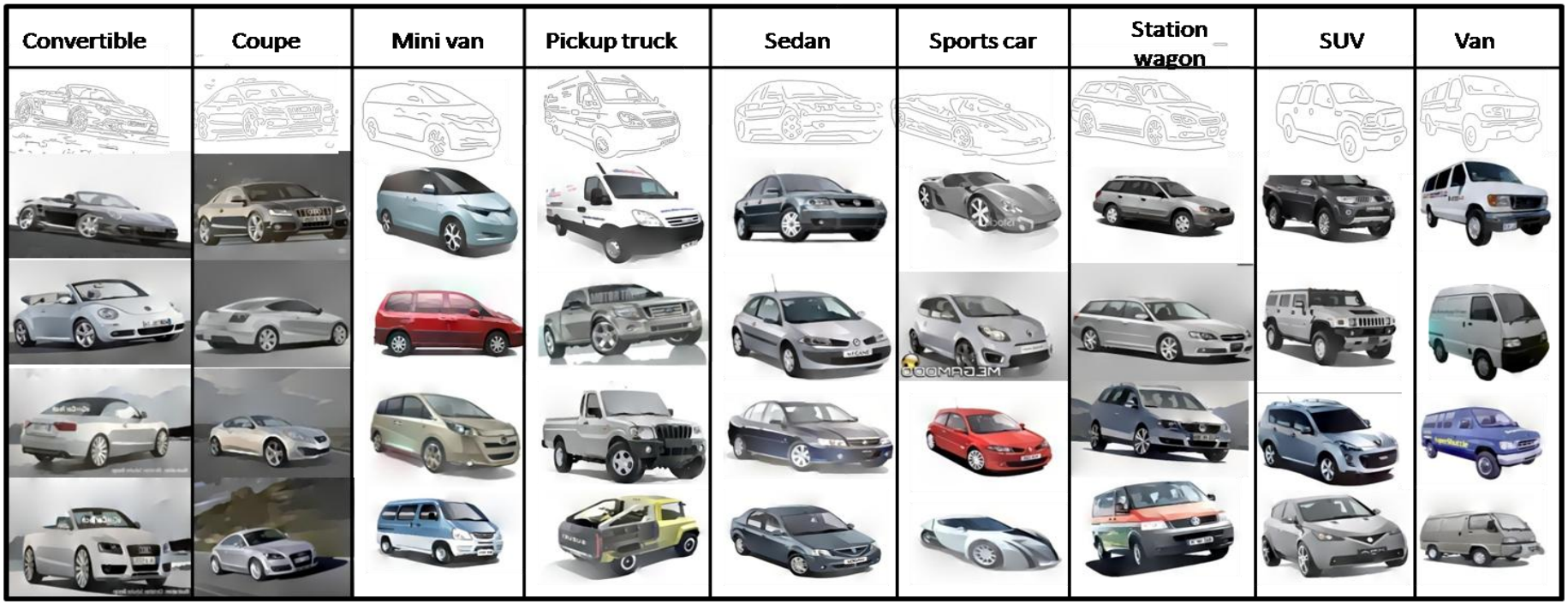
Example: average car



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Combine textual and image databases to identify visual encodings (VIEs) of abstract concepts

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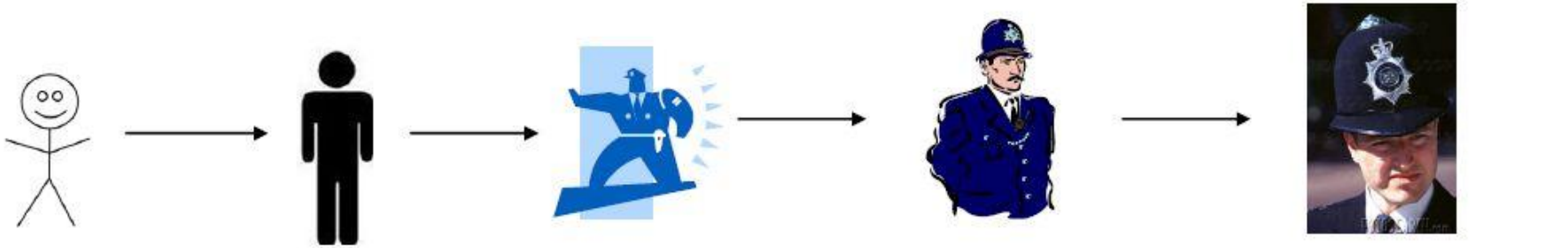

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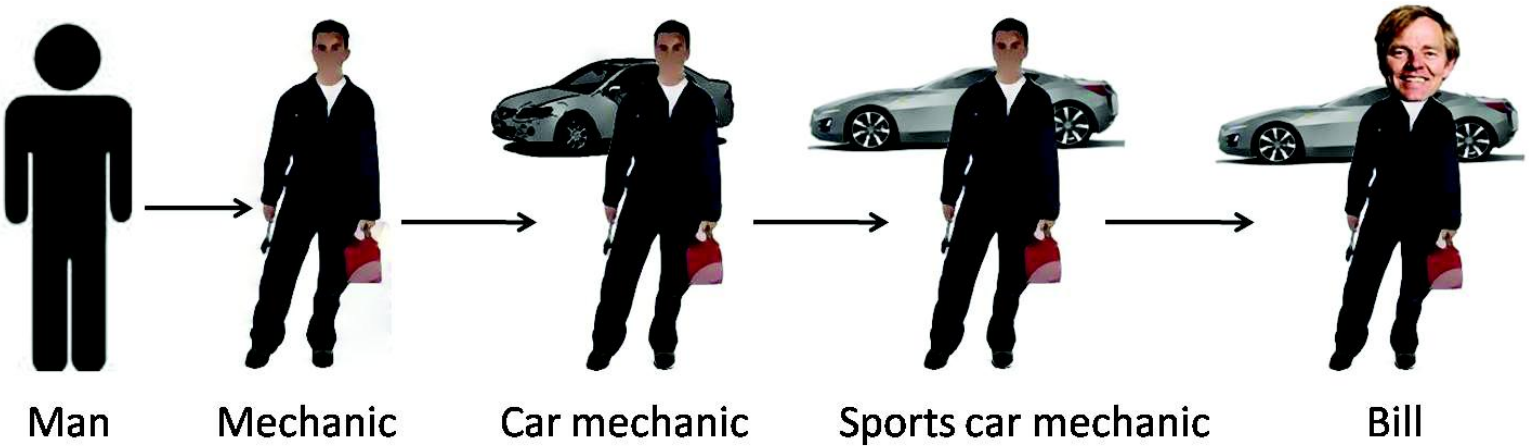
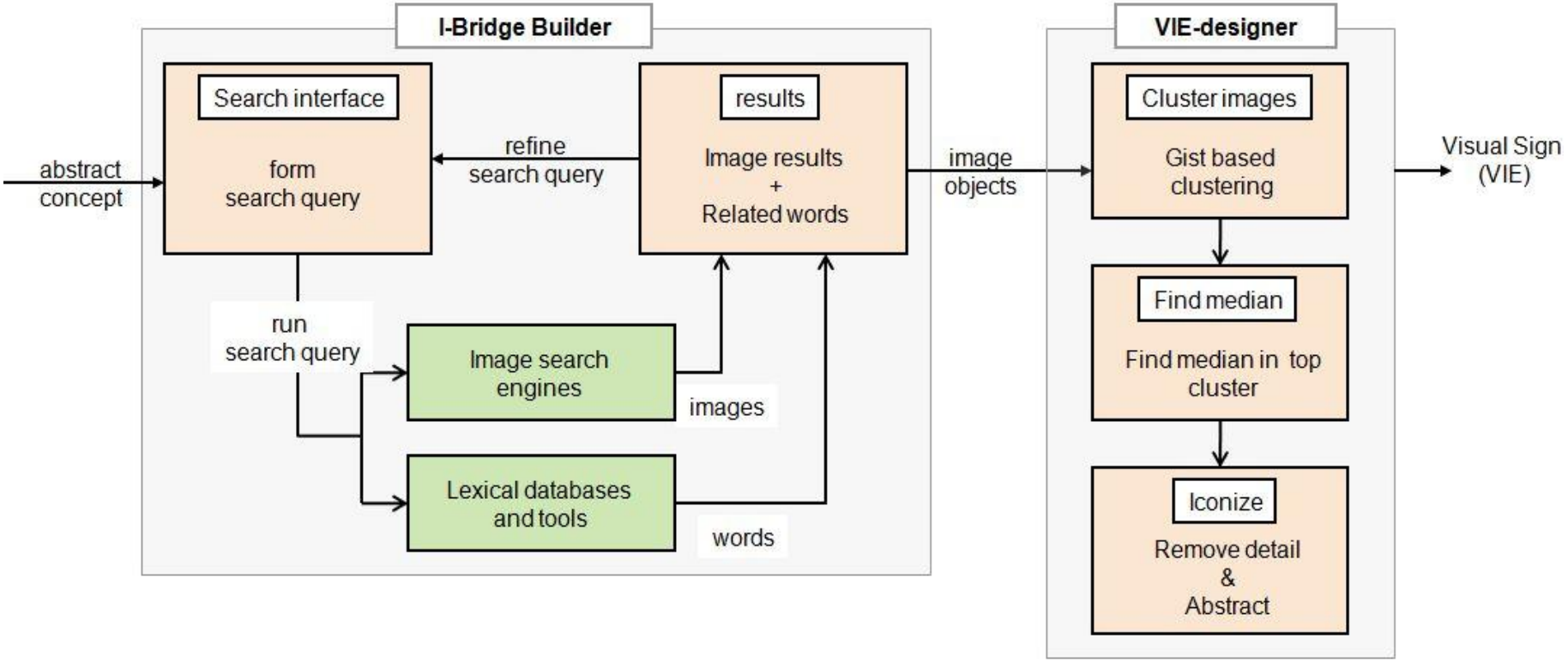


Overall Framework: Block Diagram



Interface

(c)
Translations for "travel"
French
voyager, faire un voyage, parcourir, déplacer, visiter, voyage, déplacement
Spanish
extenderse, marchar, caminar, viajar, recorrer, juerga, viajes, viaje, recorrido, turismo, de viajes, de viajar, de recorrido, de turismo, de viaje
Italian
viaggiare, andare, transitare, percorrere, spostarsi, il viaggiare, viaggi, viaggio
German
reisen, wandern, fliegen, sich fortpflanzen, Reise
Basic English
journey, go
Search
Saved Images
Word Hierarchy
(a)
travel
Search
Amazon Search
Flickr Search
powered by Google
(b)
Words related to "travel"
Relation Name
Words
Triggers
airlines, airline, fares, watkins, office, fare, guide, flight, passengers, flights, firings, airport, visitors, trips, memo, hotels, hotel, airports, voss, valerie, vacation
More general than
walk, circumnavigation, peregrination, traversal, traverse, wandering, roving, vagabondage, wayfaring, crossing, driving, riding, horseback riding, air travel, aviation, air, journey, journeying, stage, leg, staging
Specializes
motion, movement, move, trip, jaunt, go, locomote
Antonyms
stay in place
Synonyms
travel, traveling, travelling, change of location, locomotion, go, move, locomote, journey, trip, jaunt, move around
Related
travel, traveller, traveler, travelling, traveling
Coordinate Terms
motion, movement, move, trip, jaunt, go, locomote
(d)
Saved Words
Options for textboxes:
Clear
Submit
Options for words
Delete
travel
(e)
utility words
utility
equipment
supplies
gear
device
tool
(f)
Toggle Selected Images
Select Images
Save Images
Travel Information
mrmc-www.army.
... better online tra
www.travelmuse.
TRAVEL INSURANC
www.travelprotec
Travel Center
www.tsata.com
Travel Destinations
www.destination3

Visual Abstraction of Semantics

We seek a picture of the given concept that:

- unifies all of the concept's known facts
- abstracts away all unknown (or irrelevant) facts

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Ultimate goal: construct an average image (exemplar) for the given concept

- preserve semantic level of detail (the concept category)
- look for features that are common across a set of queries
- abstract away those features not in common
- do this at a low-level scale

Example: Abstracted Blender

Blender 1:

Blender 2:

After edge filtering:

- randomly sample edge (feature) points
- align using the Hungarian algorithm
- determine shape-context vector v_s
- measure similarity between two points (Euclidian v_s distance)

Remove poor feature point matches based on:

- low shape-context feature similarity
- large distances in image space (indicating false matches between points in very different parts of the object)

The green points above are those with no good match

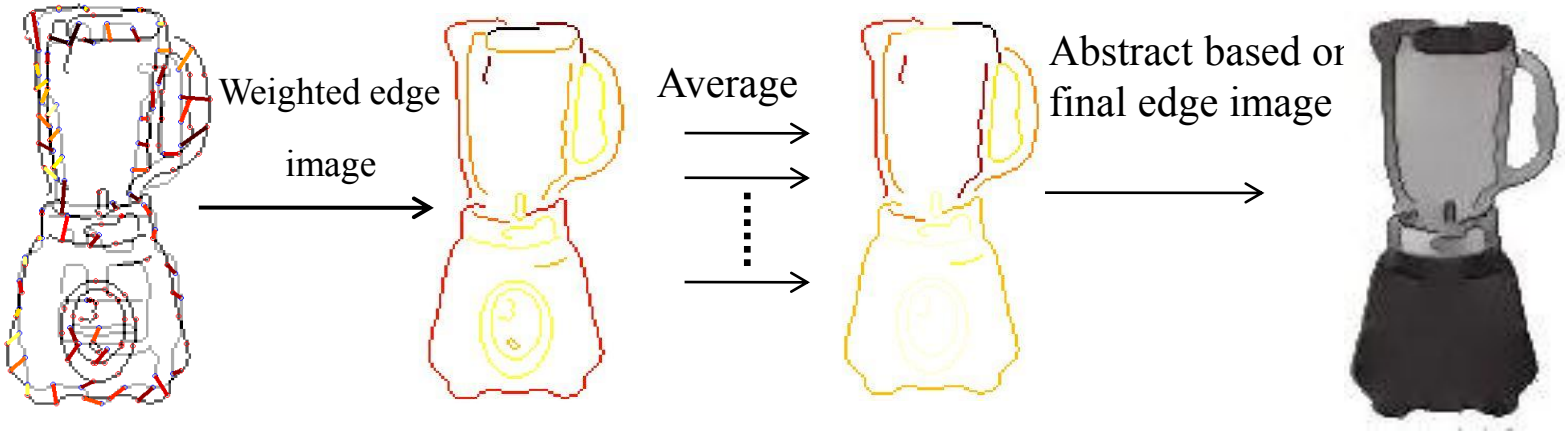
Example: Abstracted Blender

Blender 1:

Blender 2:

Building the average/exemplar from many examples:

- here shown two



Average blender

Example: Taxonomy of Small Appliances

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Conclusions

Presented an approach for finding good visual information encodings for concepts

Required the integration of many fields

- linguistics
- vision
- computer graphics
- user interfaces (for the human in the loop)

We believe that our framework has great prospects for:

- design of clip art for taxonomies, book illustrations, etc.
- expressive augmentation of graphical node/link diagrams to make these much more engaging and informative

Future Work

Fully integrate our framework into a graph drawing engine

- use abstractions to summarize certain facts and attributes
- use compositions for compact visual story telling with context and key players
- apply within a visual analytics interface

Expose framework to a wider circle of users, over the web

- will likely result in much more robust icons
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