How machines help in finding the right career

Recommendation Systems

lmc

Value for customers

- find things that are interesting
- narrow down the set of choices
- help to explore the space of options
- discover new things
- entertainment

Value for provider

- unique personalized service for the customer
- increase trust and customer loyalty
- increase sales, click rates, conversion etc.
- opportunities for promotion, persuasion
- obtain more knowledge about customers

Basic Concepts

Data objects

- user
- item

User properties

- user_id
- name, work, skill

Relations between them

- detail view
- purchase

Item properties

- item_id
- title, description
- salary, availability

Two Major Approaches

Content-based recommenders

- user preferences and interests
- user profile
- matching with the item attributes

Collaborative filtering recommenders

- user-item interactions
- predicting future interactions

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Collaborative filtering recommenders

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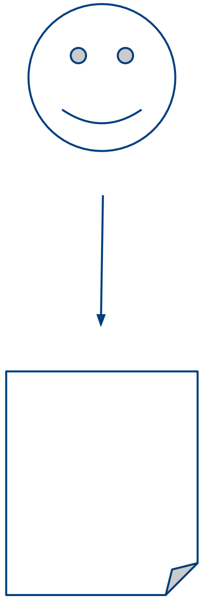
- predicting future interactions

Collaborative Filtering

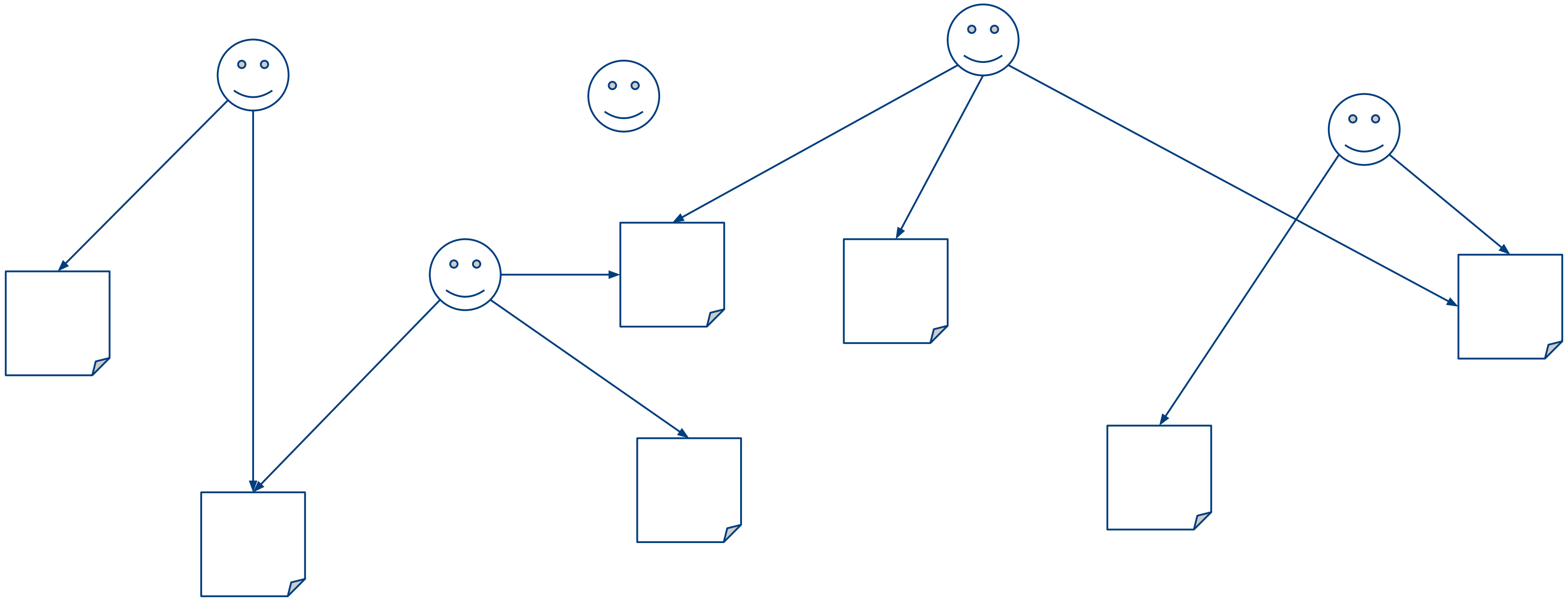
Collaborative Filtering

User-Item Interactions

- explicit
  - users rate items
- implicit
  - detail view
  - cart addition
  - purchase



Collaborative Filtering | User-based Recommendation



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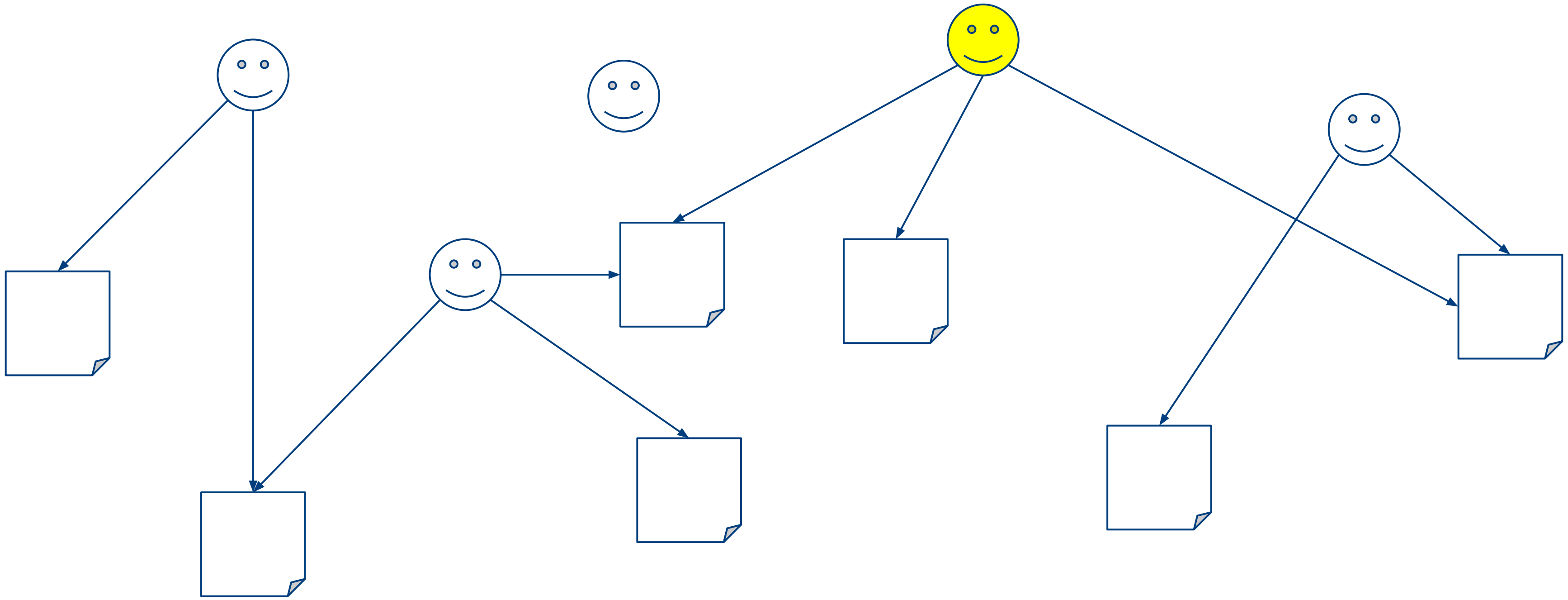

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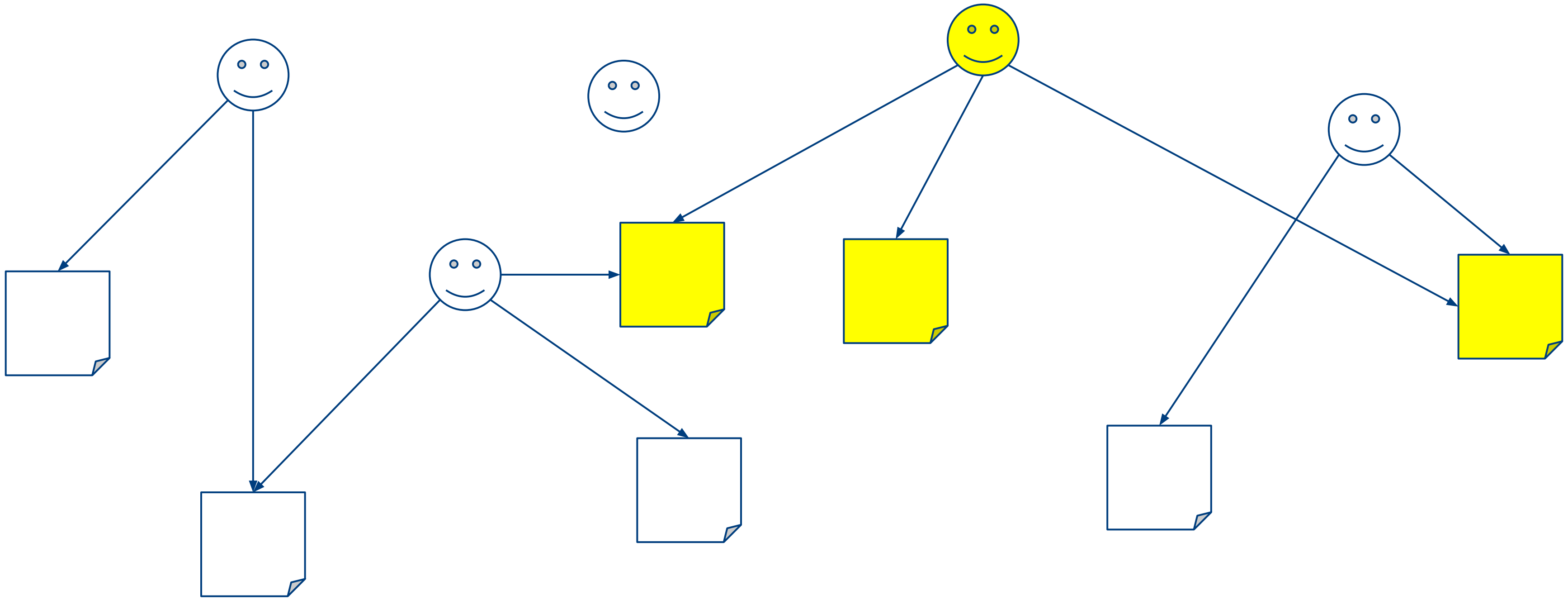

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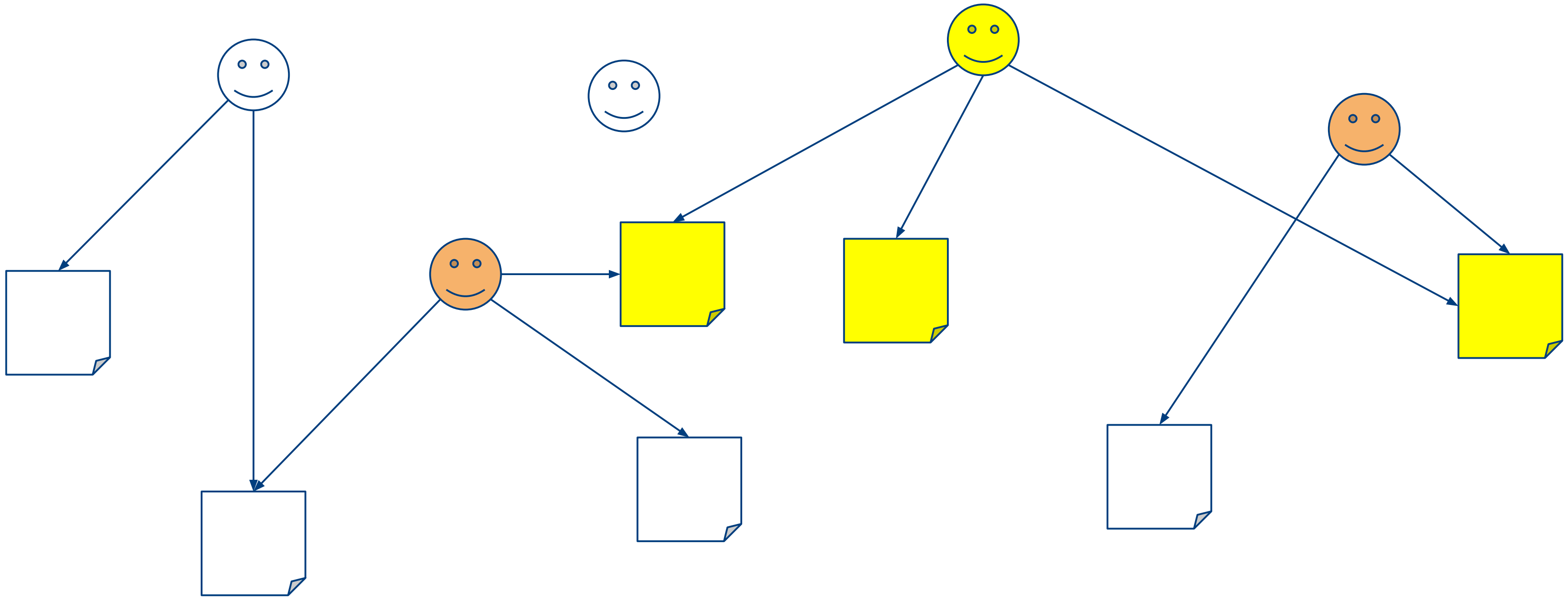

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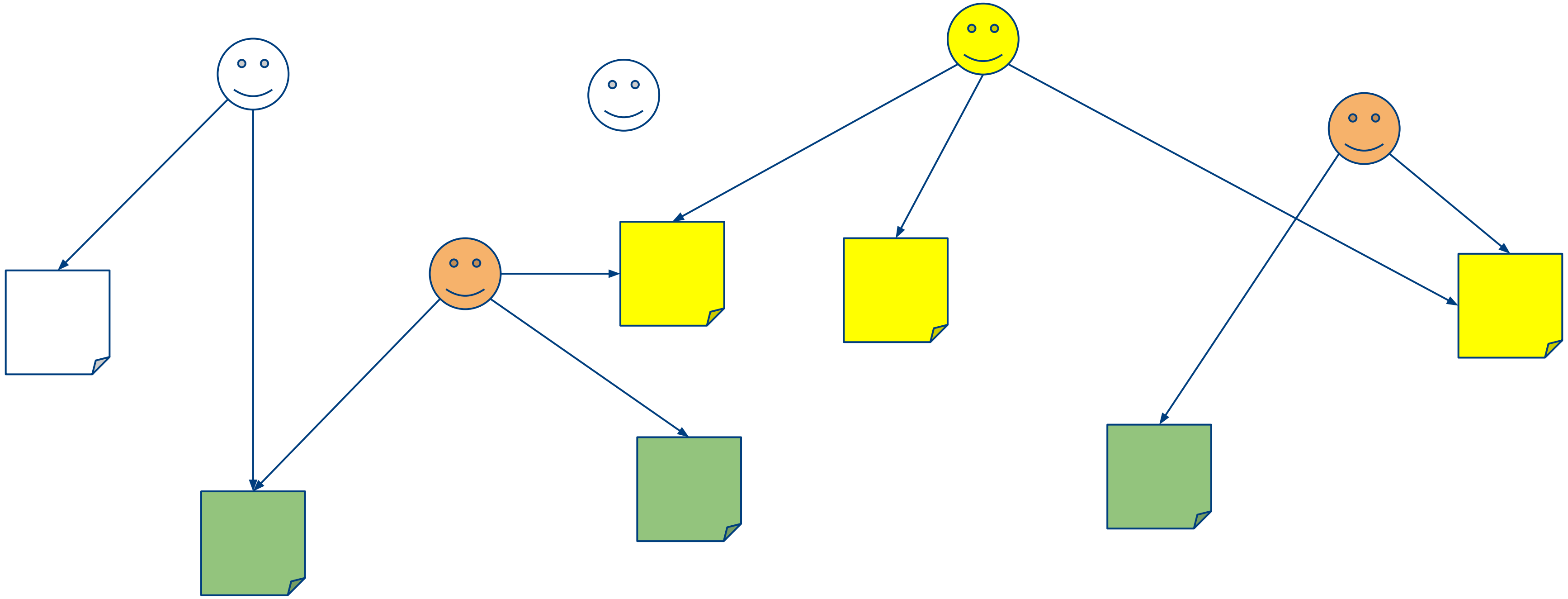
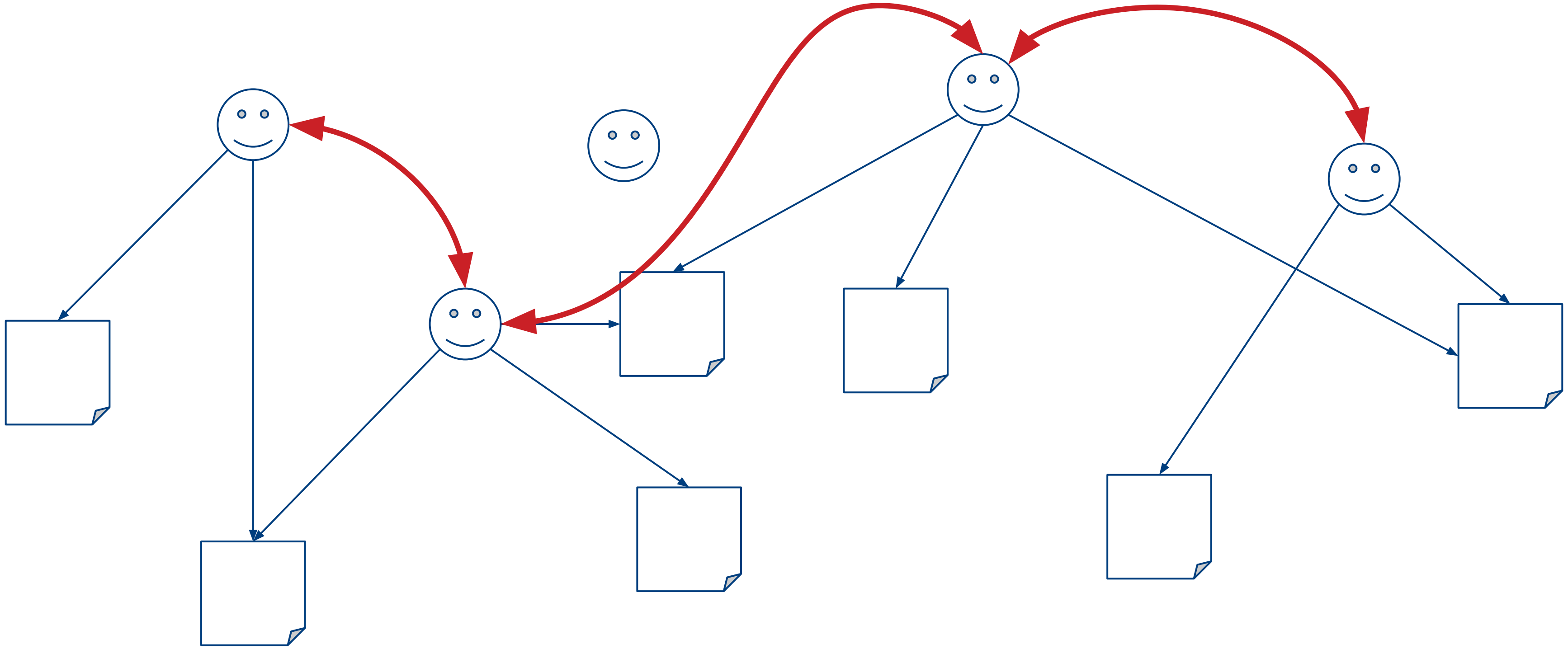
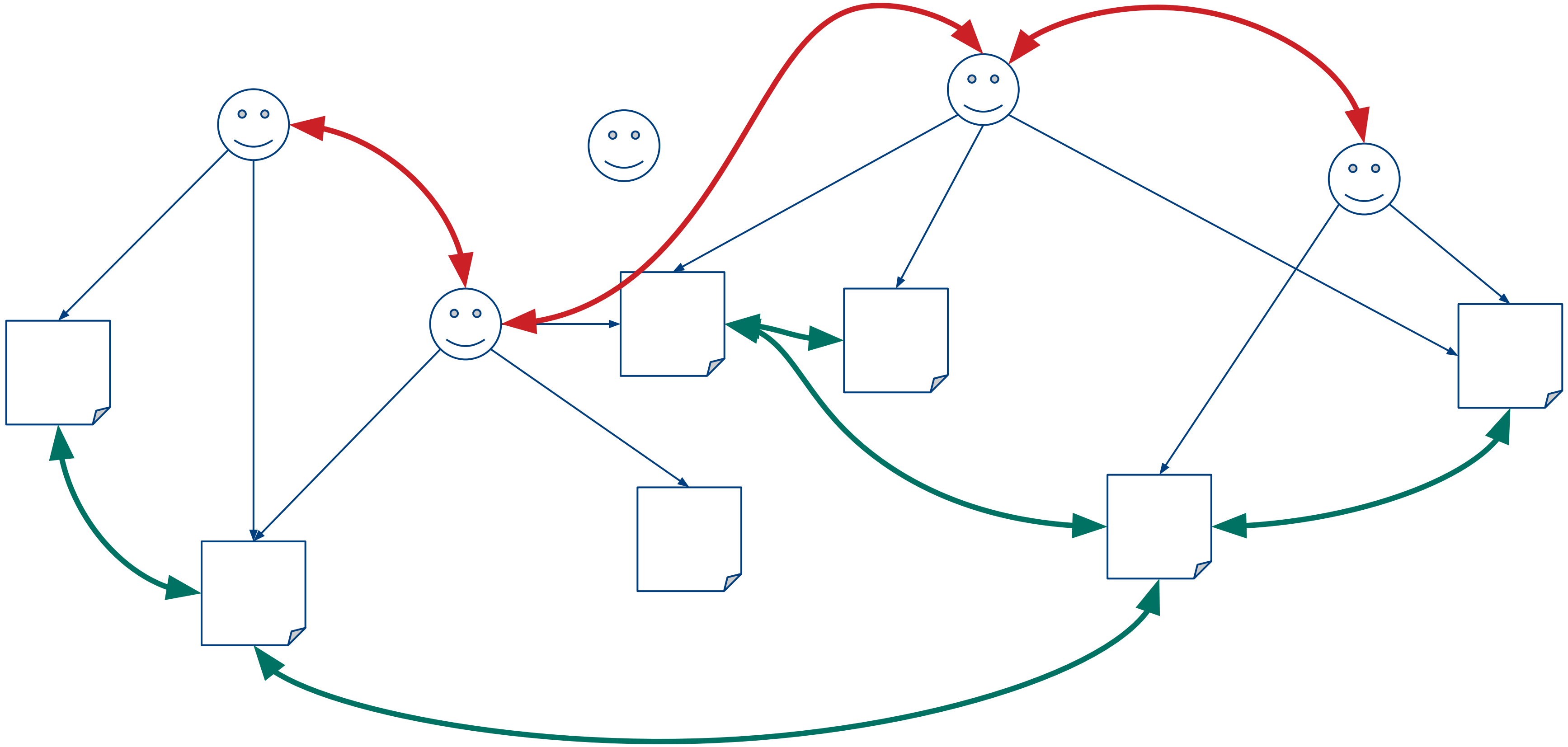


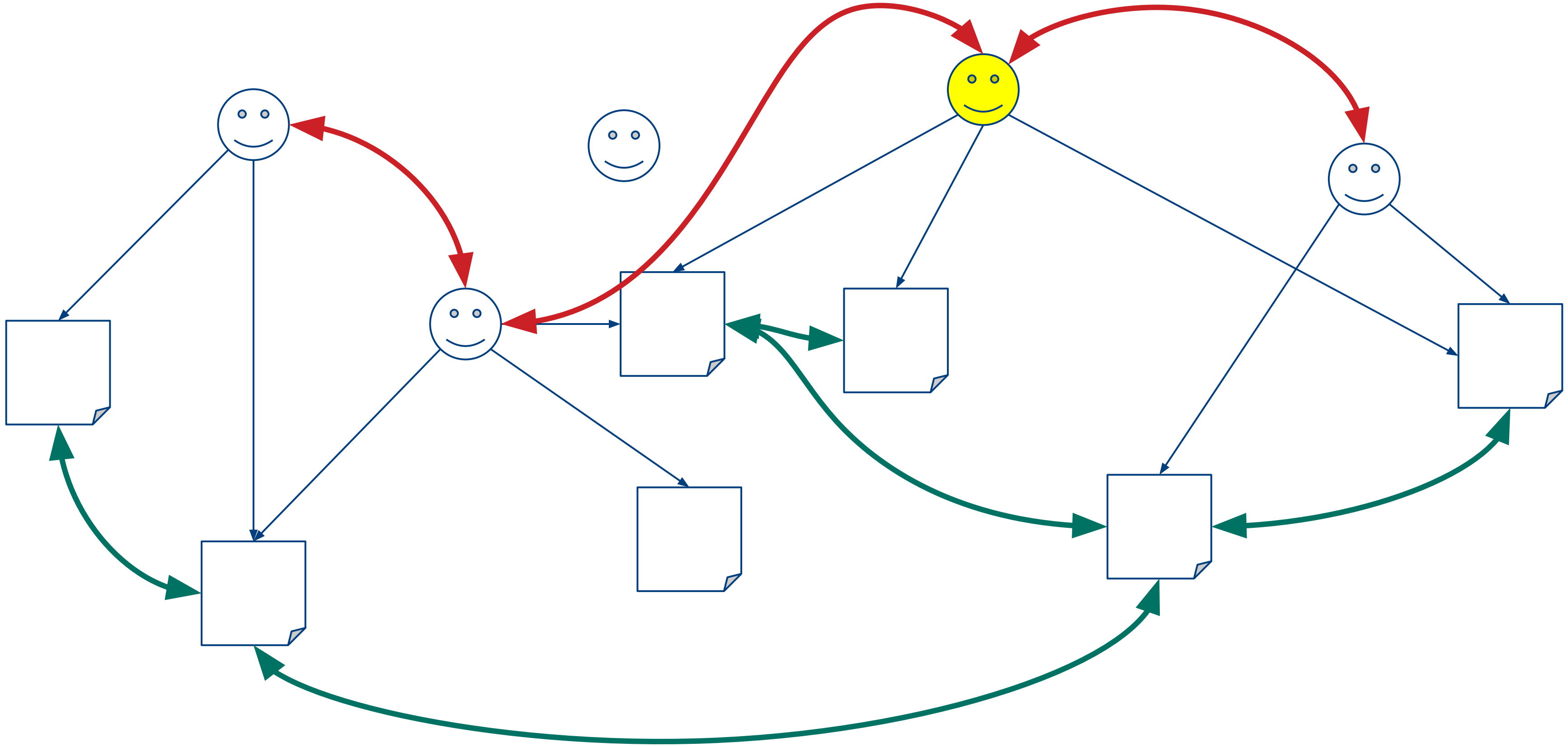
Collaborative Filtering | User Neighbours



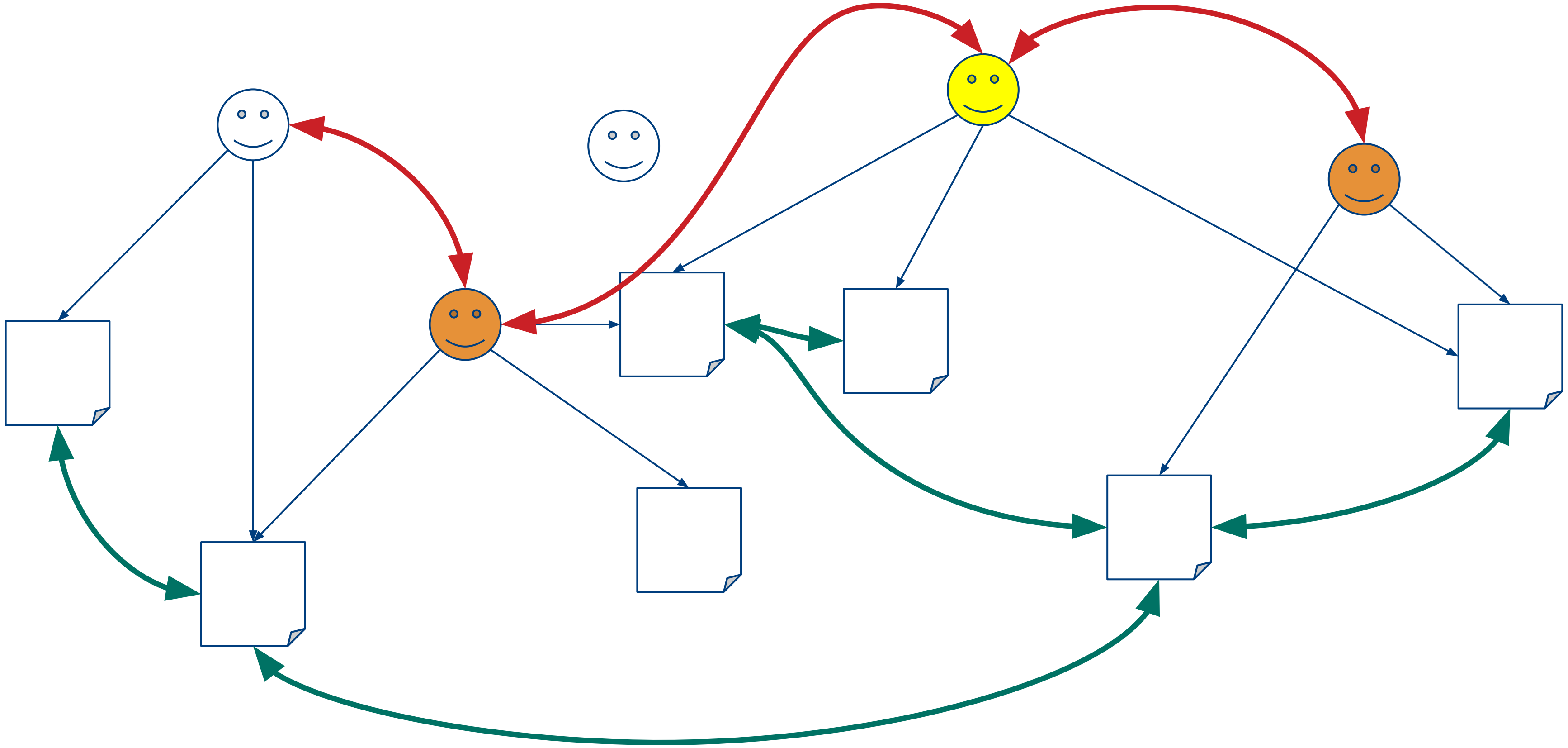
Collaborative Filtering | Item Neighbours



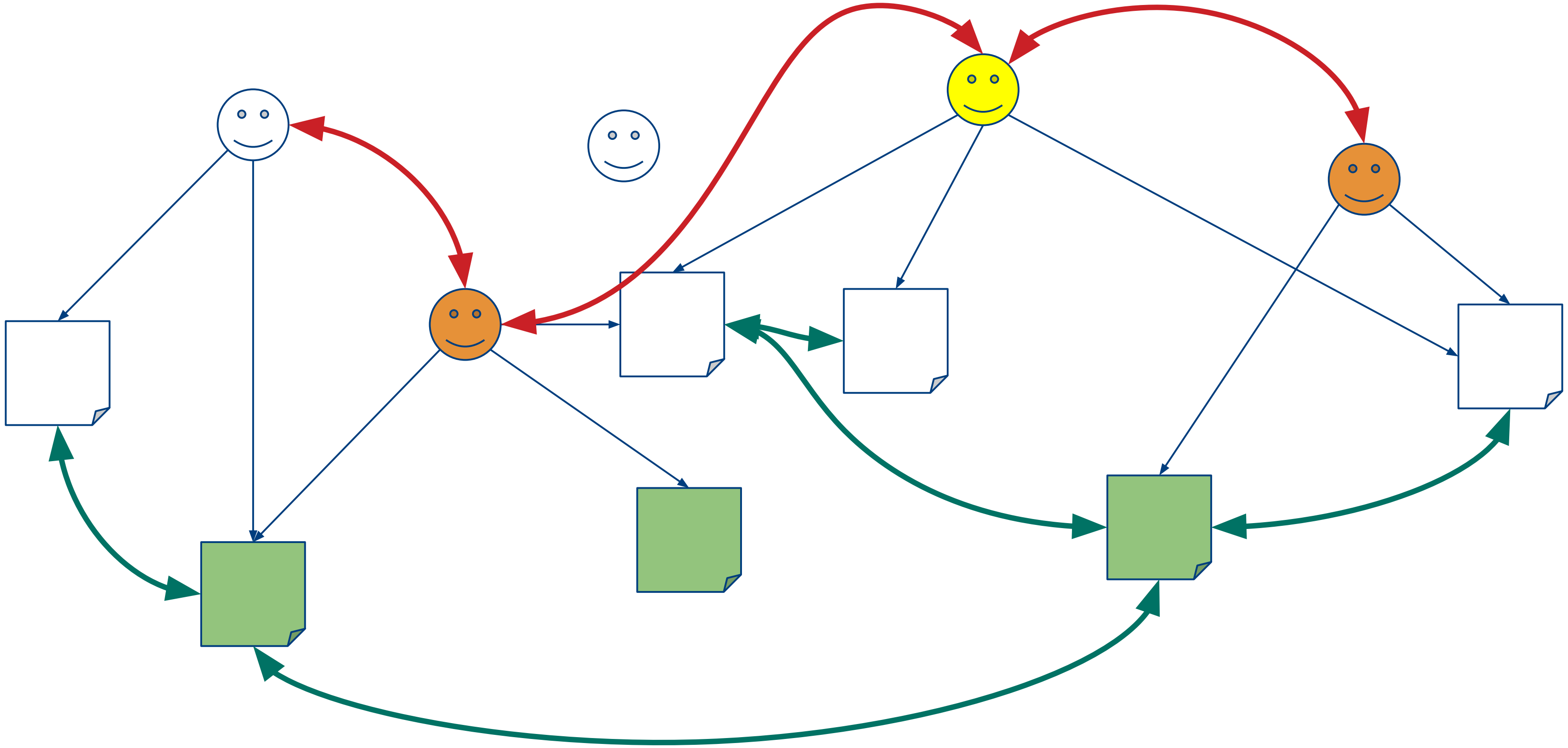
Collaborative Filtering | Neighbour-based Recommendation



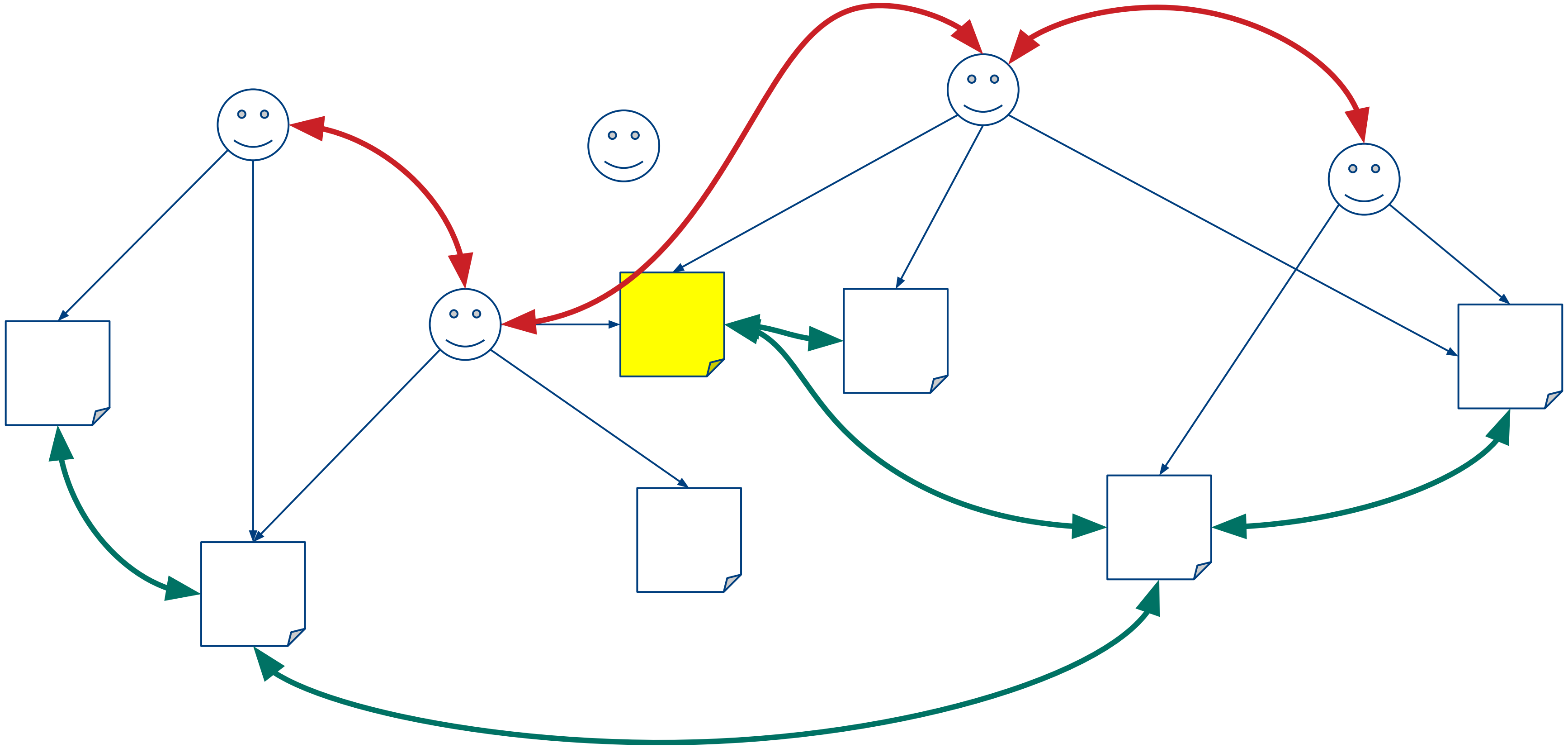
Collaborative Filtering | Neighbour-based Recommendation



Collaborative Filtering | Neighbour-based Recommendation



Collaborative Filtering | Item-based Recommendation



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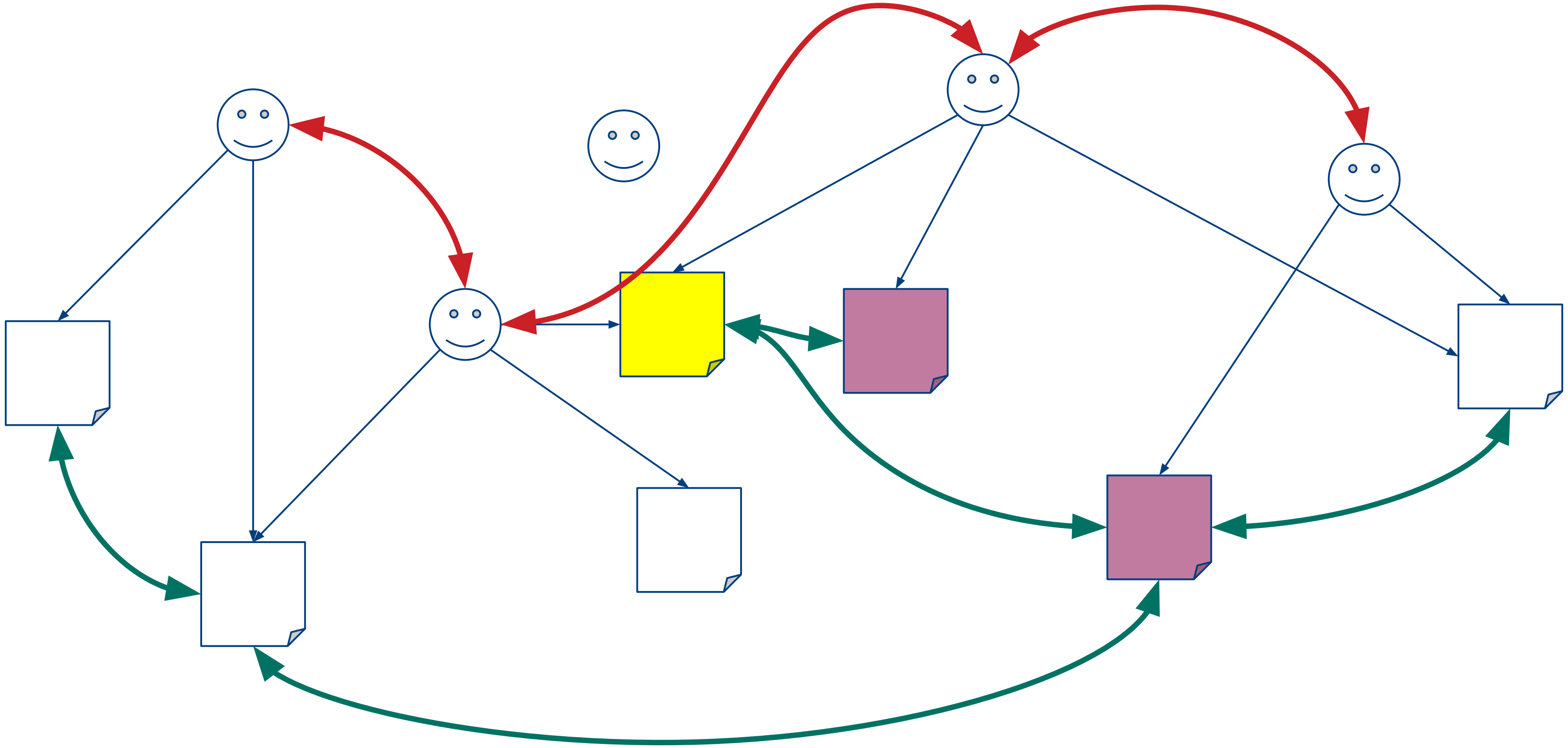
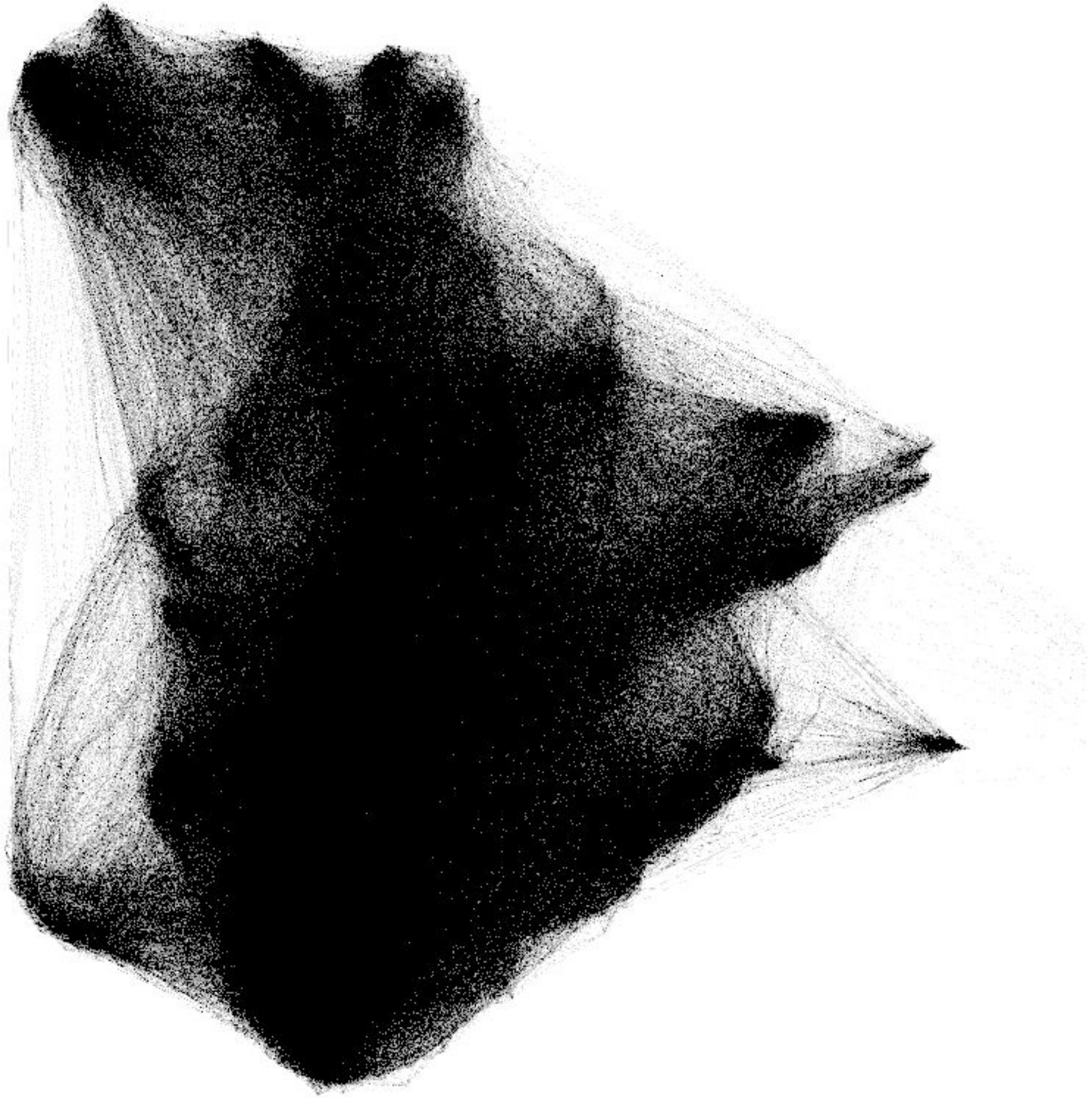


Collaborative Filtering

Well, in fact… :-)

- millions of users
- thousands of items



Text processing

The Document Parser

Document parser

- advanced **machine learning** techniques
- currently supported are **CVs and job offers** in **Czech language**
- framework for parsing **any type** of documents in **any language**

Document parser

Input:

- different formats (PDF, DOC, DOCX, ODT, TXT)
- different layouts
- (almost) free texts

Document parser

Output:

- structured data
- uniformed and normalized

Document parser

Personal

- Name
- Birthday
- Marital Status

Contacts

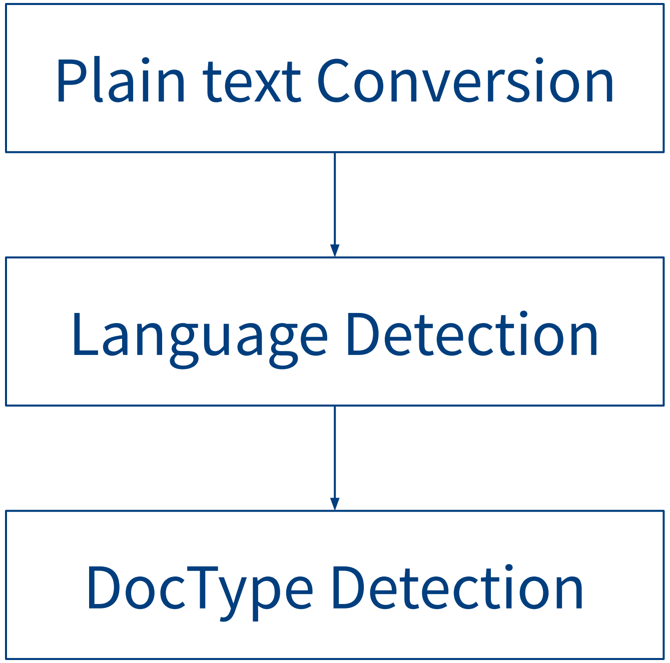
- Postal address
- Phones
- Emails

Work Experience

- From/to
- Company
- Job title

Document Parsing Strategy

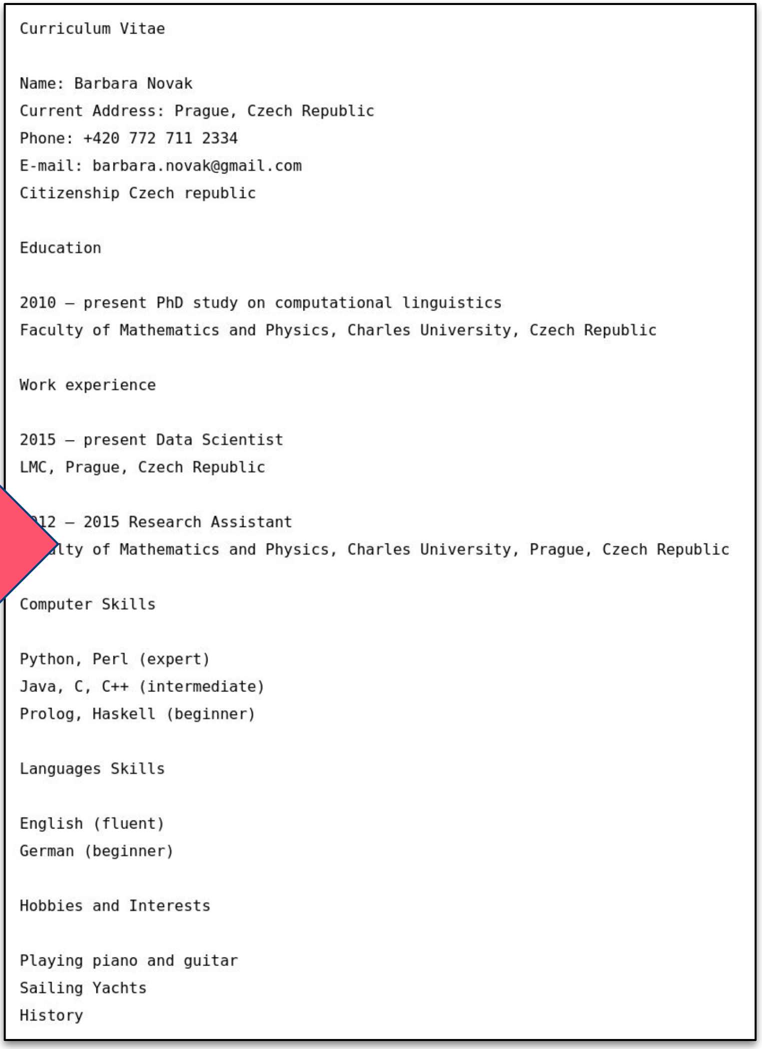
Document parser Processing Pipeline



Plain text Conversion

Language Detection

DocType Detection



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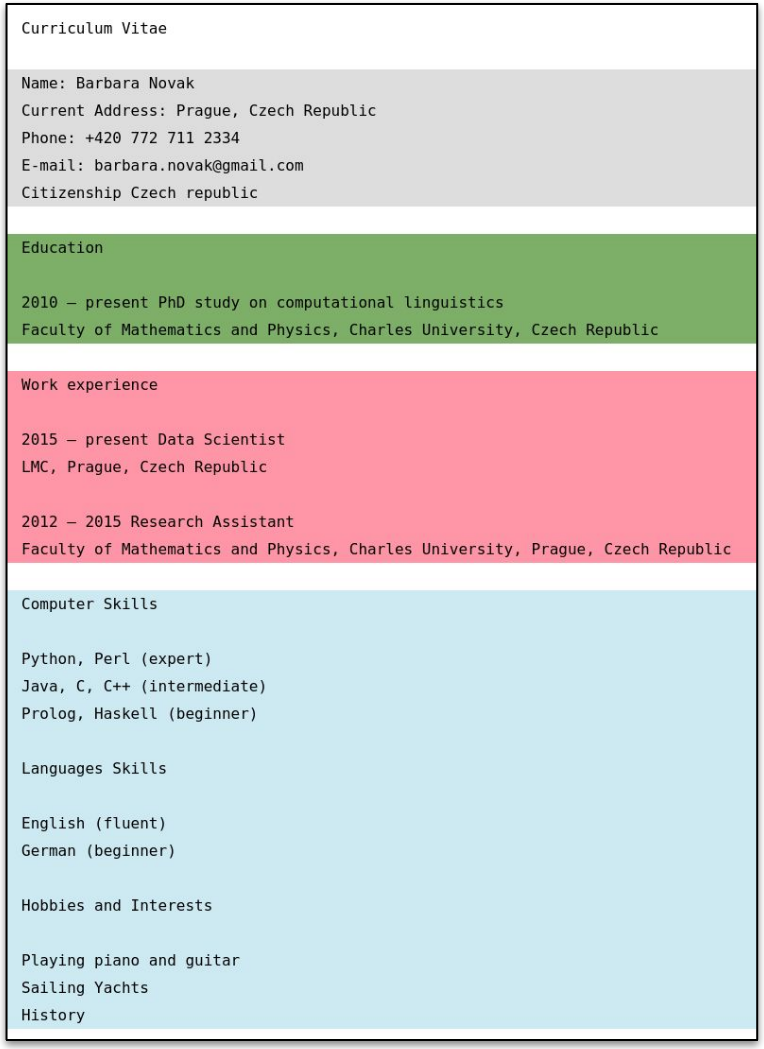
Document parser Processing Pipeline

Section Detection



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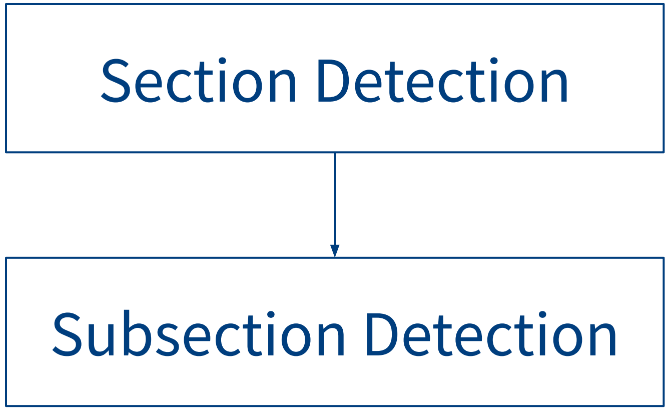

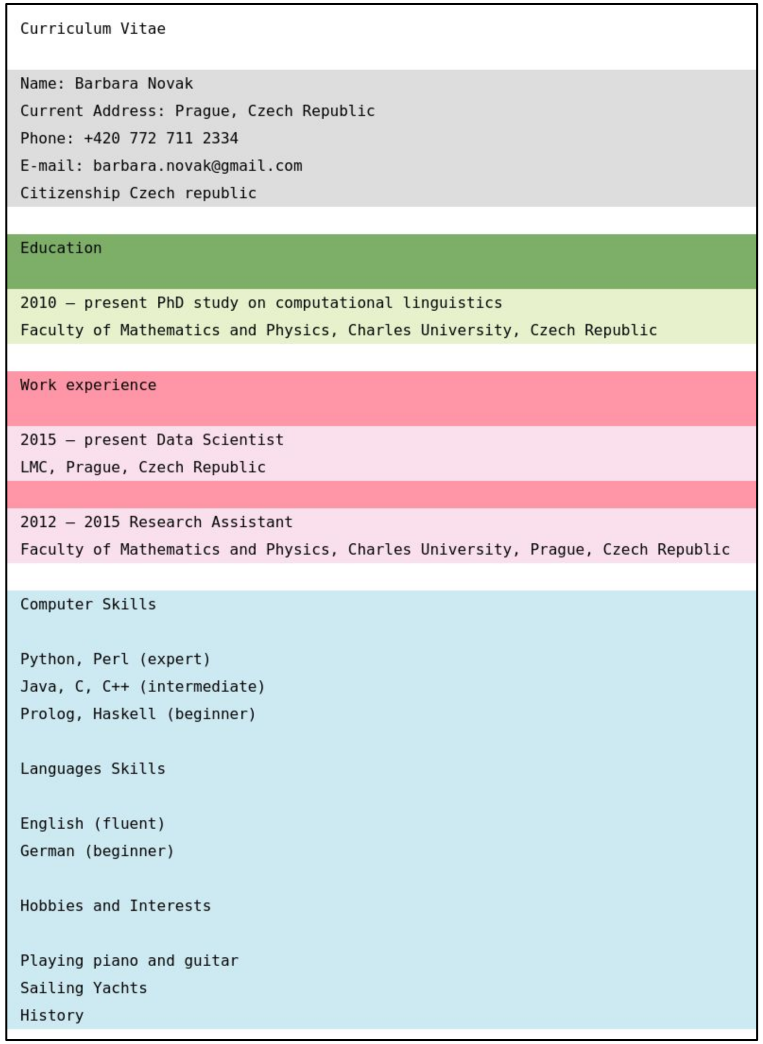

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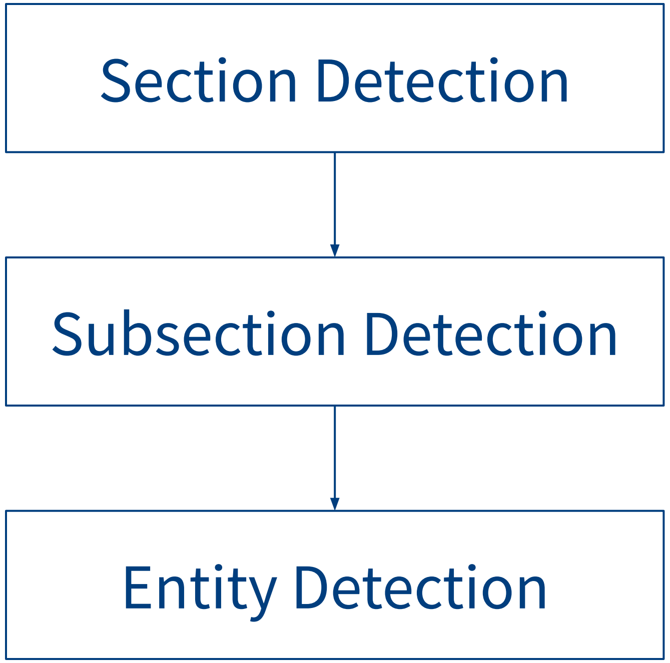
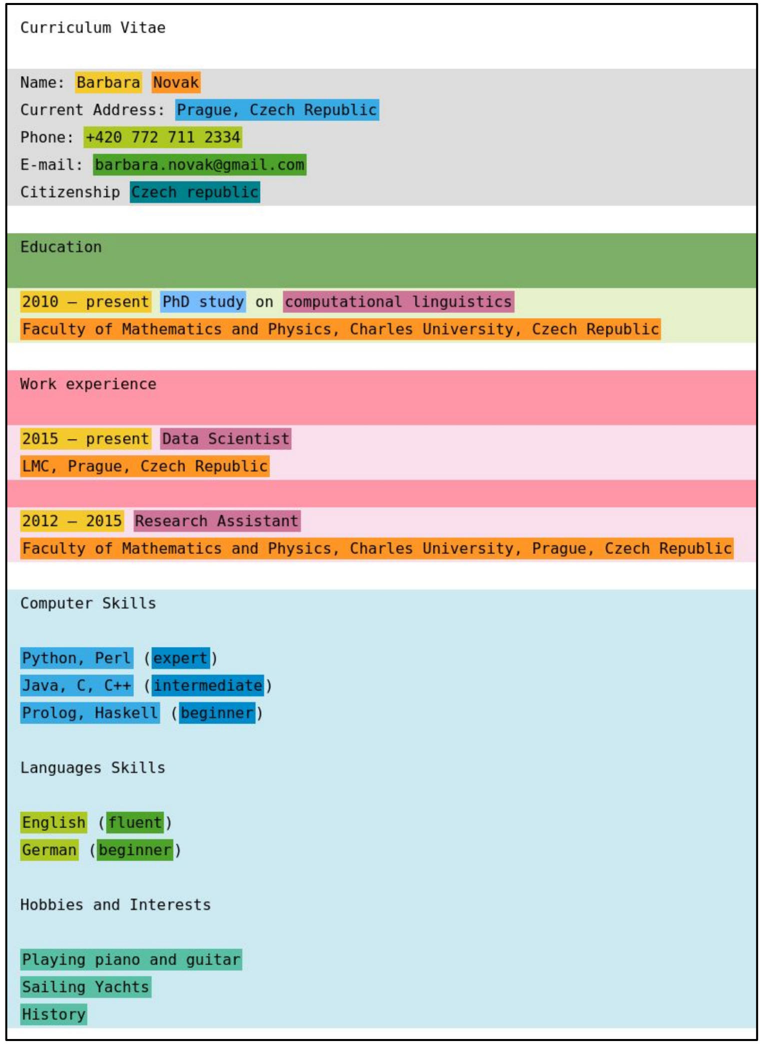


Section Detection

Subsection Detection

Entity Detection



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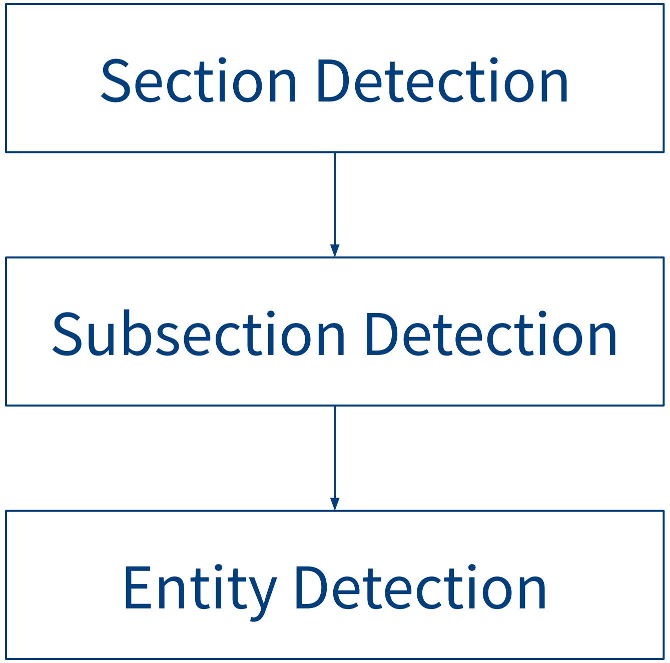
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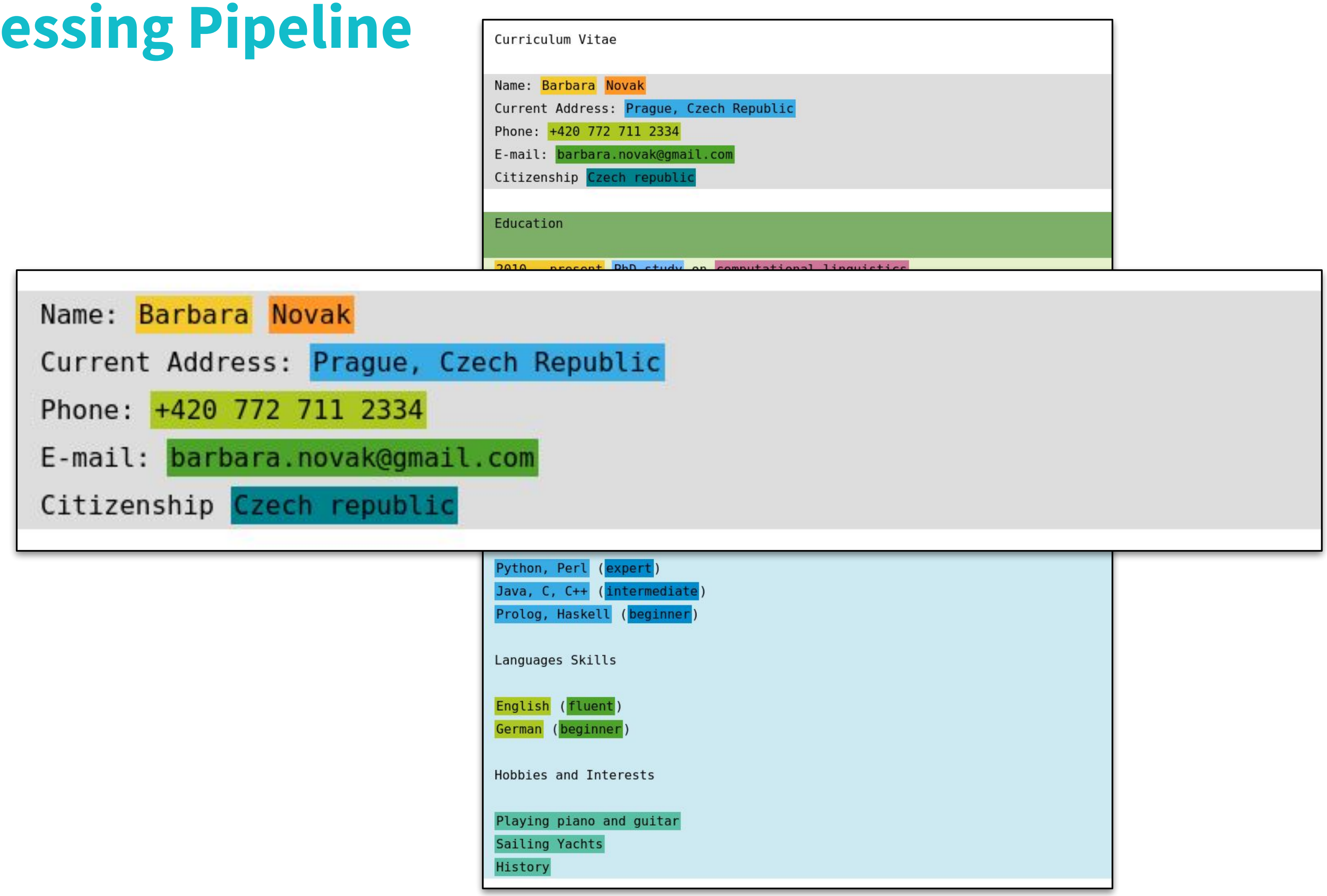
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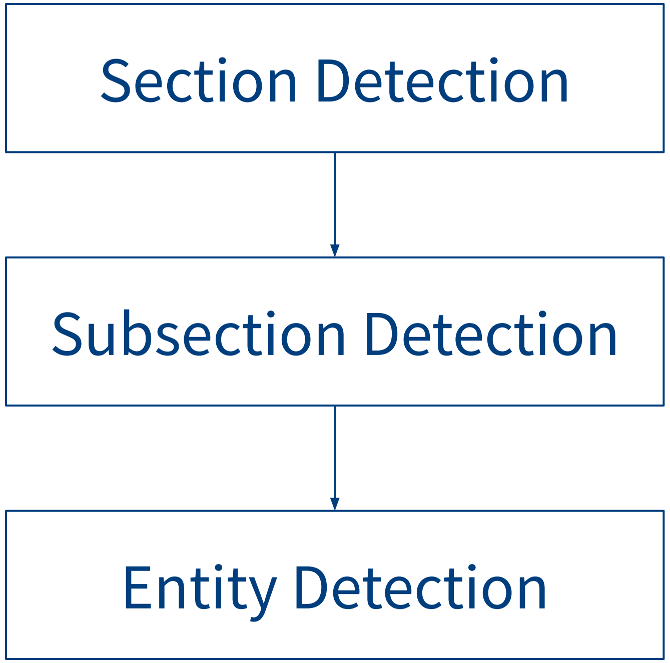

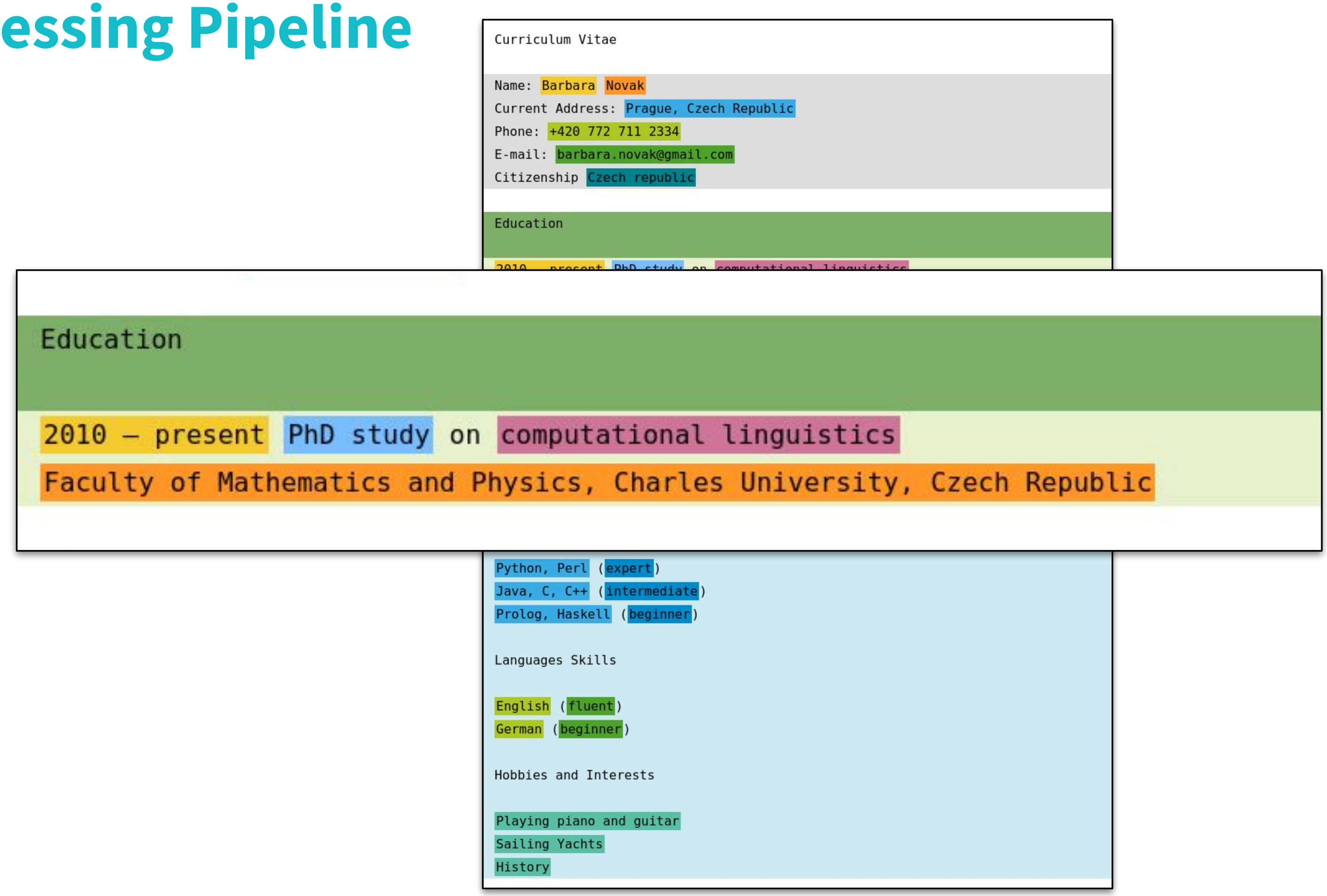

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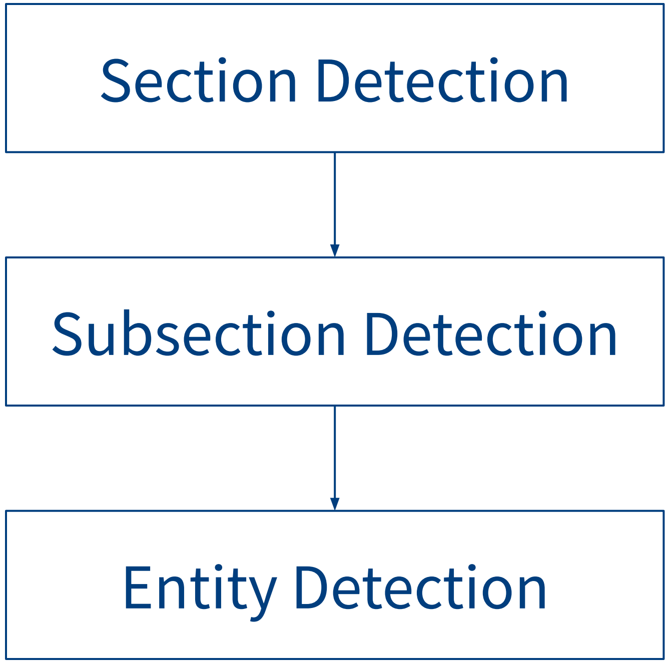
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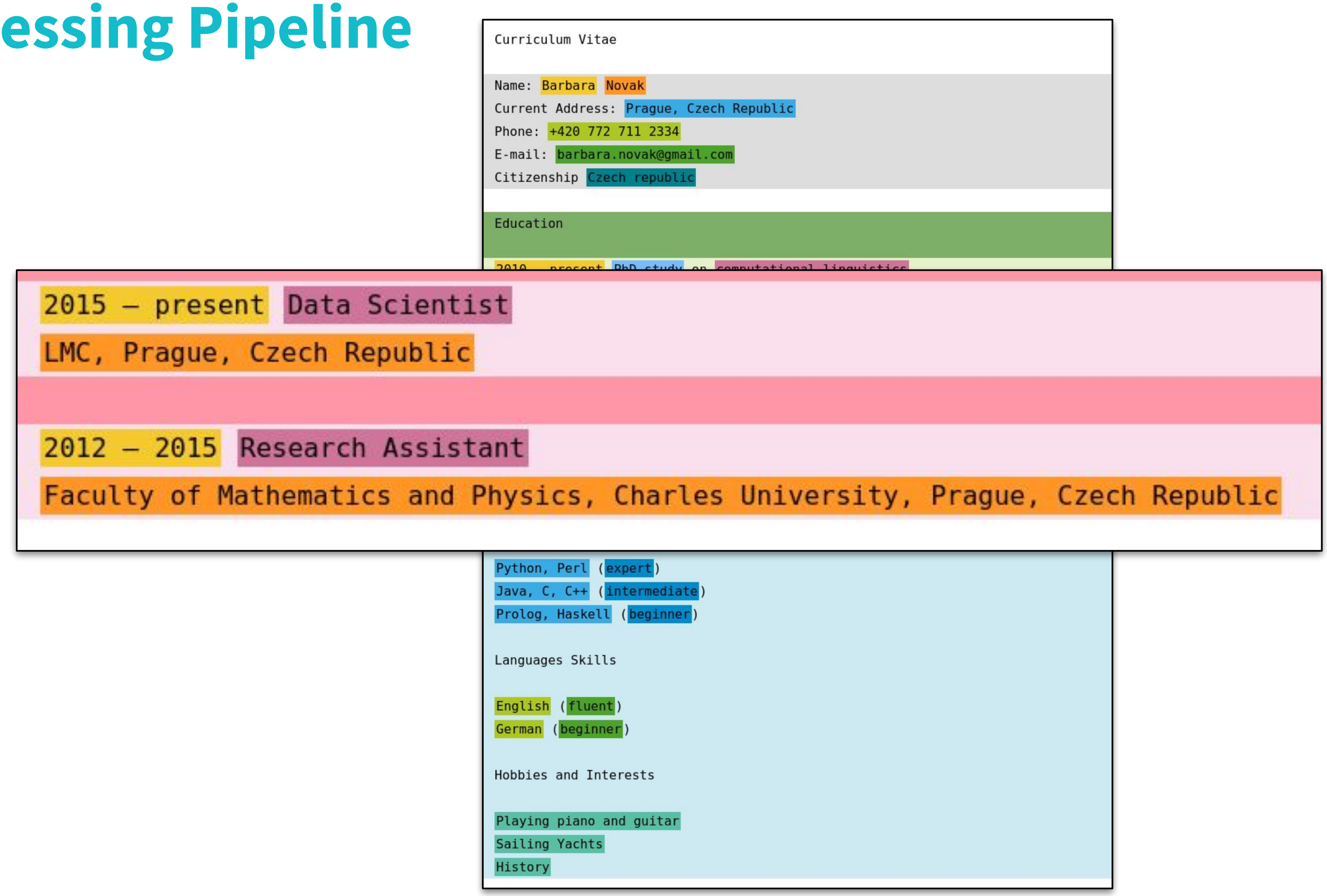
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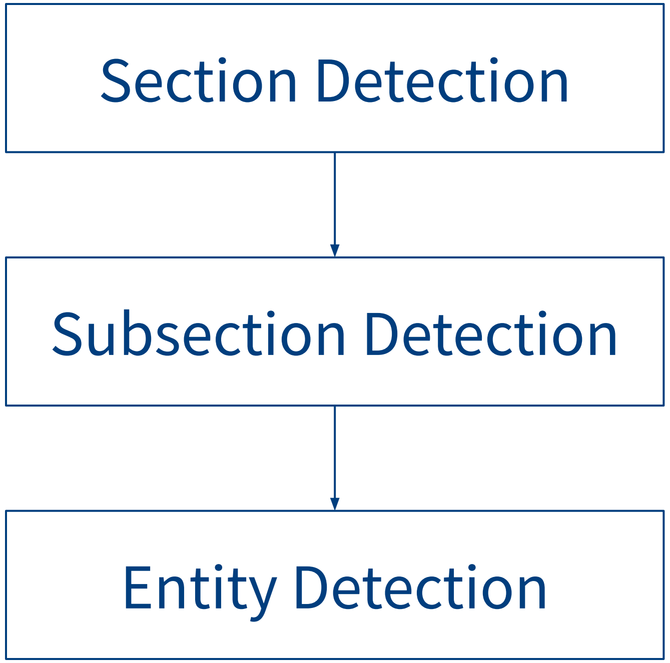

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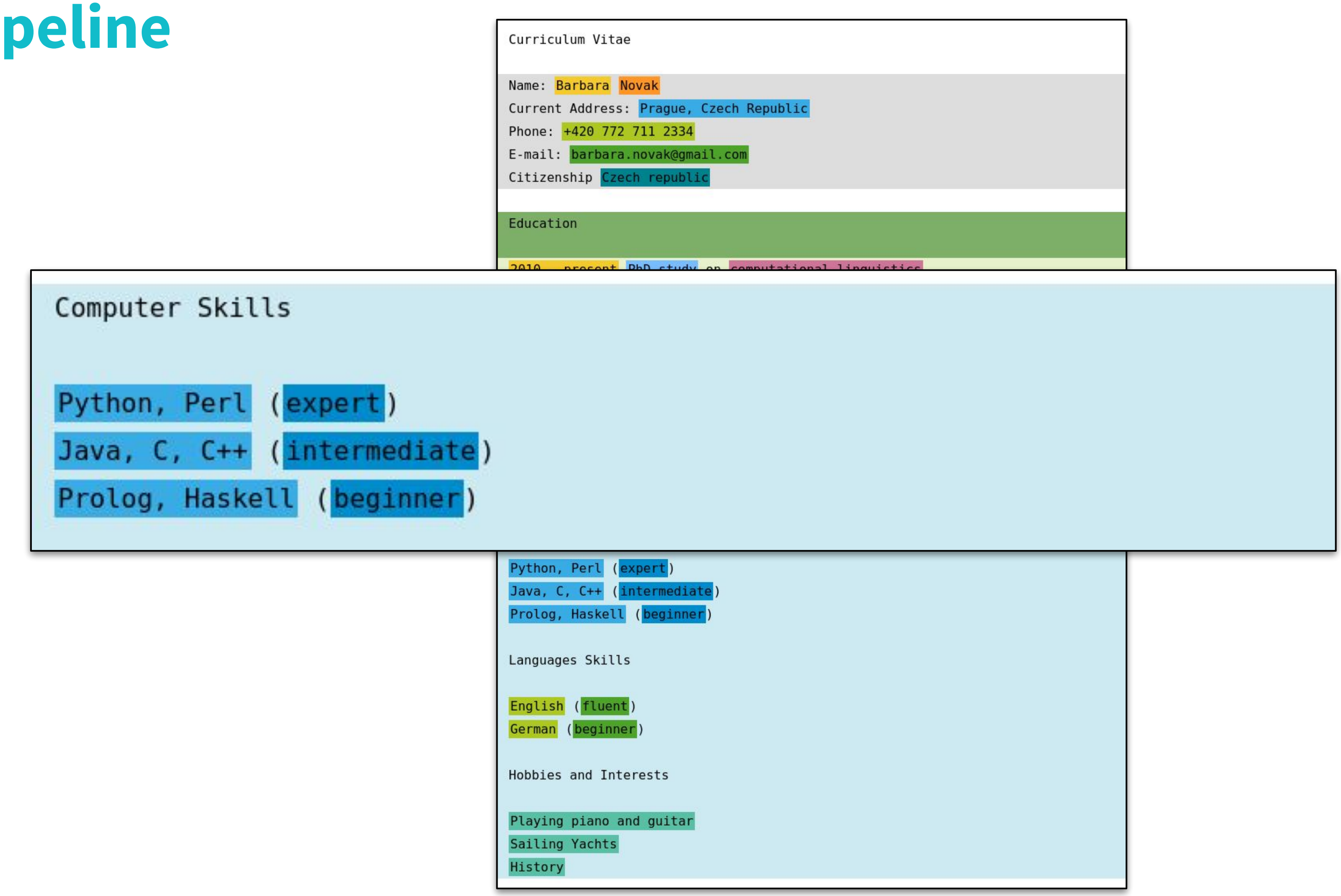

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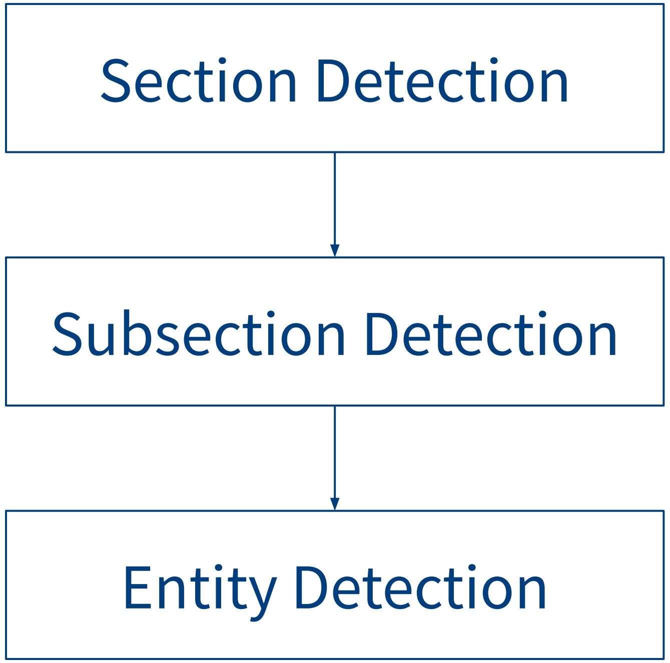

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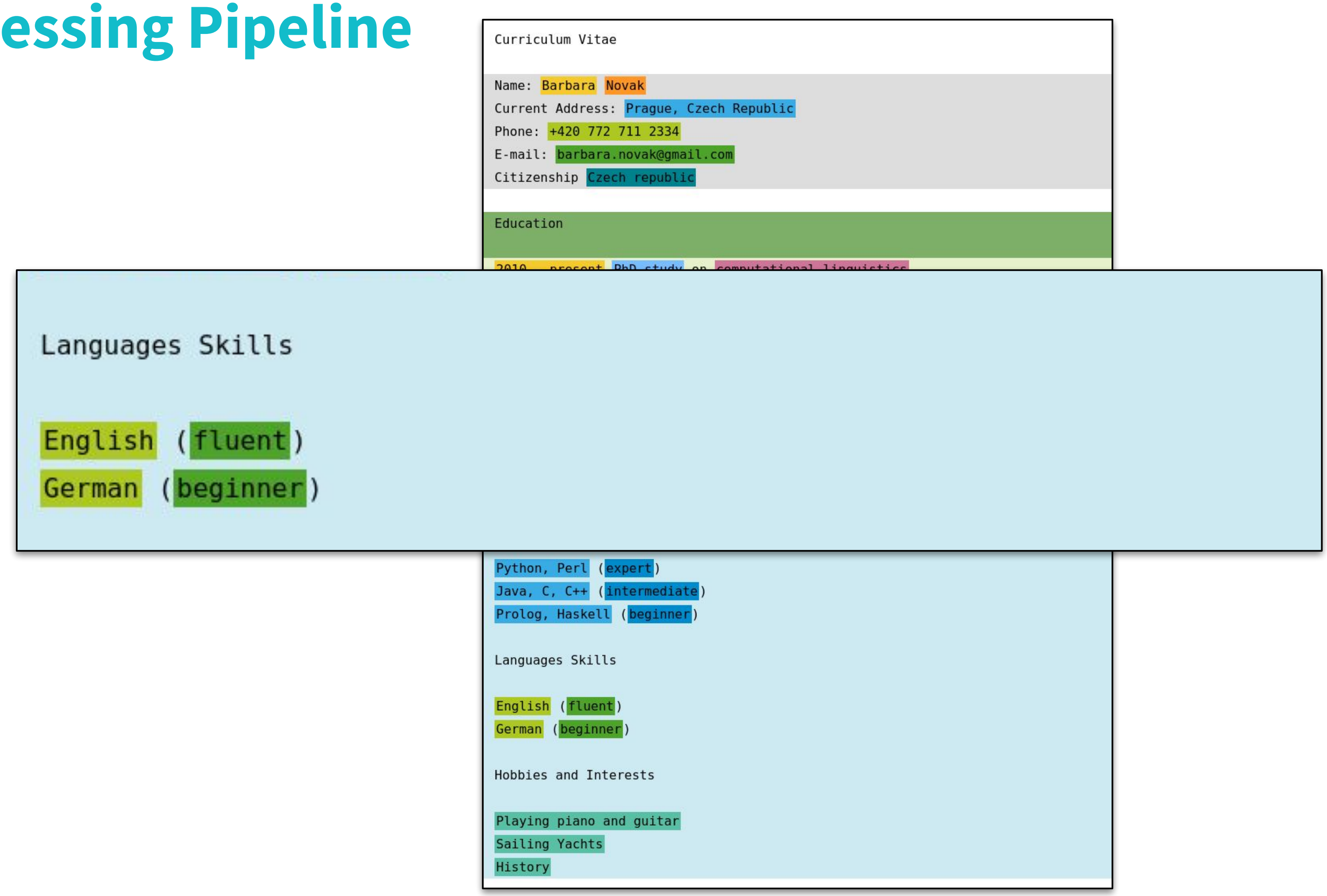

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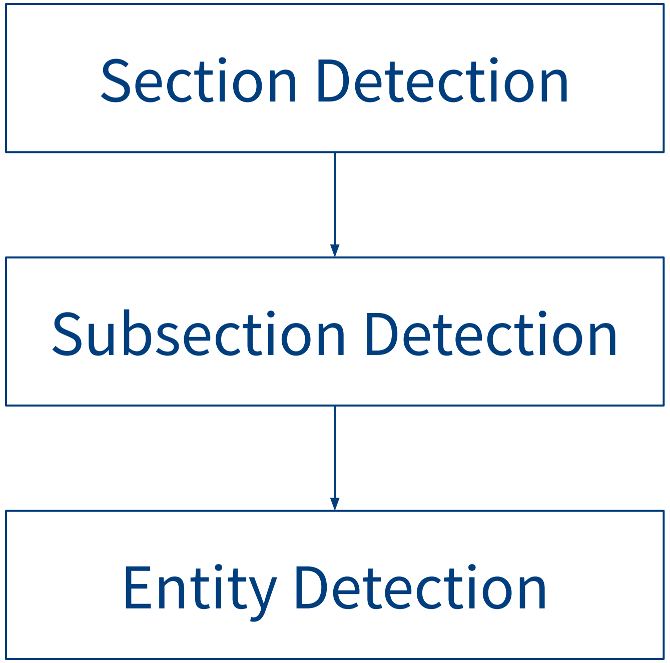

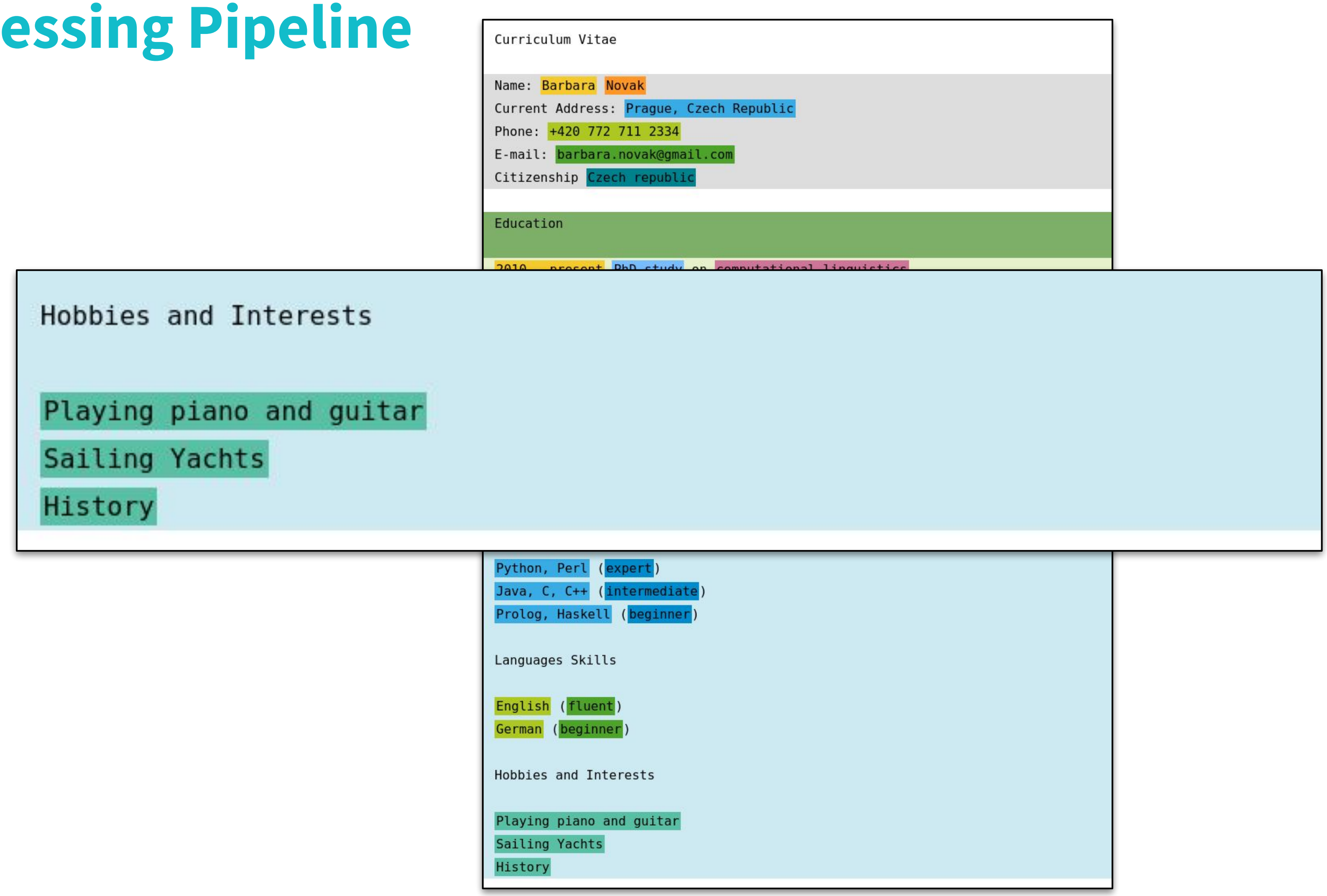

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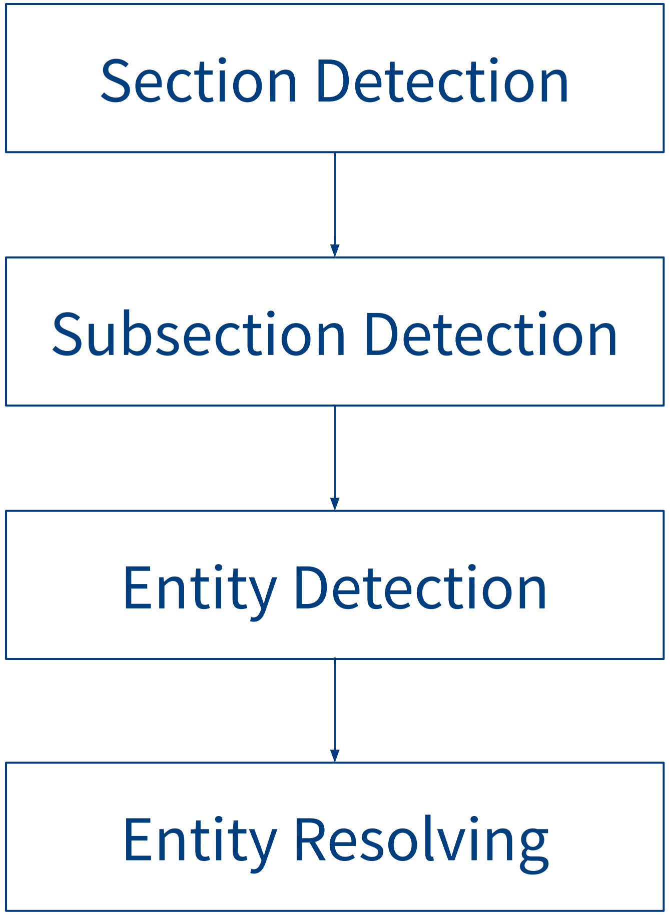
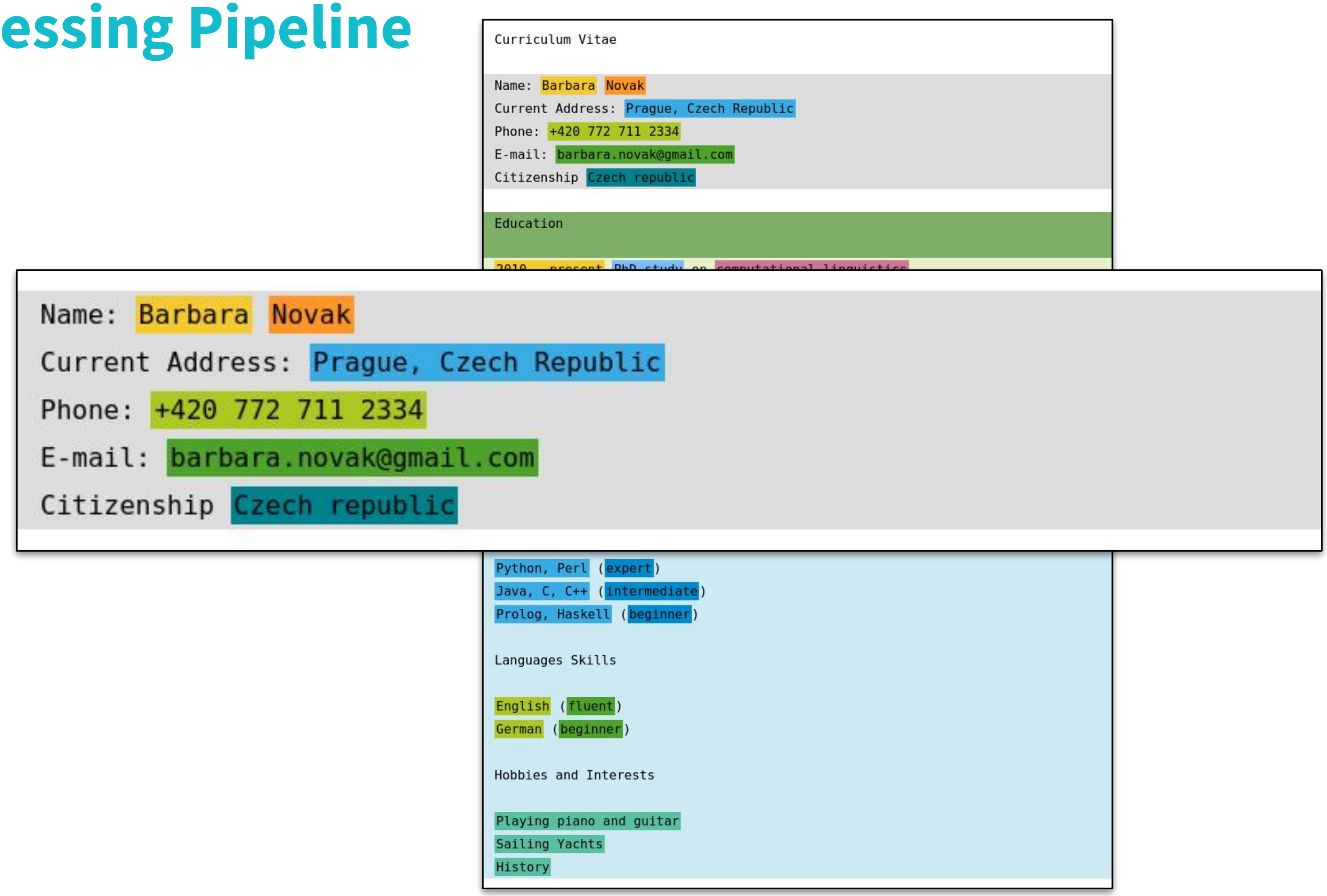


Section Detection

Subsection Detection

Entity Detection

Entity Resolving



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Document parser ML Framework

Document parser Machine Learning Framework

Divide and Conquer Strategy

Sequence Labeling Models

- (sub)sections detectors
- entity detectors (one per section)

Normalization

- simple rules

Document parser Machine Learning Framework

Training from Examples

- language and type specific
- cca 10k documents for **Czech CVs** → reliable performance (>95%)

Document parser Machine Learning Framework

Manual Document Annotation

- our own web application for annotators

Data Quality

- annotation manual (20 A4 pages with instructions for Czech CVs)
- annotators selection
- on-line helpdesk for questions

Document parser Performance on Czech CVs

Detector	Performance
Personal Section Detection	97 %
Experience Section Detection	98 %
Work Experience Subsection Detection	96 %
Personal Entity Detection	94 %
Work Experience Entity Detection	93 %

Question time.

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