The Hochschul-Assistenz-System HAnS: An ML-Based Learning Experience Platform

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HAnS Hochschul-Assistenz-System

Bundesministerium für Bildung und Forschung

Introduction

- Project goal: Development of an learning experience platform
- Supports students & lecturers in online learning & teaching through machine learning (ML) methods
- Agile open-source collaborative project of 11 partners
- Technical development: Technische Hochschule Nürnberg, Technische Hochschule Ingolstadt, and Hochschule Hof
- Supported by qualitative and quantitative assessments
- Funded by the BMBF program ”Digitale Hochschulbildung”

Current State

- HAnS provides an intelligent ML-based search engine
- Students can search videos:
  - For terms tagged on the specific lecture video metadata
  - For a spoken term within a specific video and skip to the exact position:

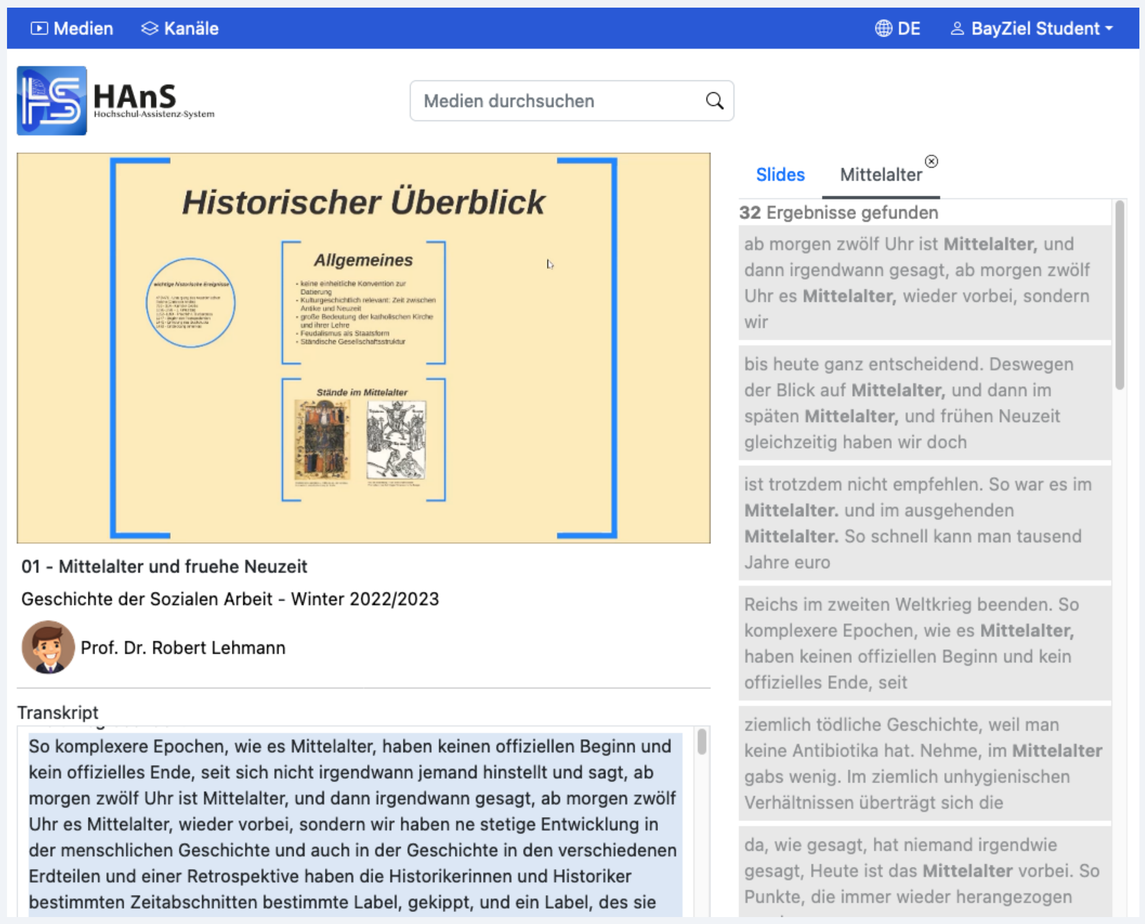

Figure: Frontend video page with search results.

Universities and Partners

- Bayerisches Zentrum für Innovative Lehre (BayZiel)
- Hochschule Ansbach
- Hochschule Augsburg
- Hochschule Hof
- Hochschule Neu-Ulm
- Hochschule Weihenstephan-Triesdorf
- Evangelische Hochschule Nürnberg (EVHN)
- Technische Hochschule Ingolstadt
- Technische Hochschule Nürnberg Georg Simon Ohm
- Technische Hochschule Ostwestfalen-Lippe (THOWL)
- Open Resources Campus NRW
- Virtuelle Hochschule Bayern

ML-Pipeline Overview

- Teaching & learning support: lecture material integration from common German e-learning platforms
- Uses Automatic Speech Recognition, Natural Language Processing, and Image Processing
- Direct acyclic graph in Apache Airflow for processing the lecture videos:

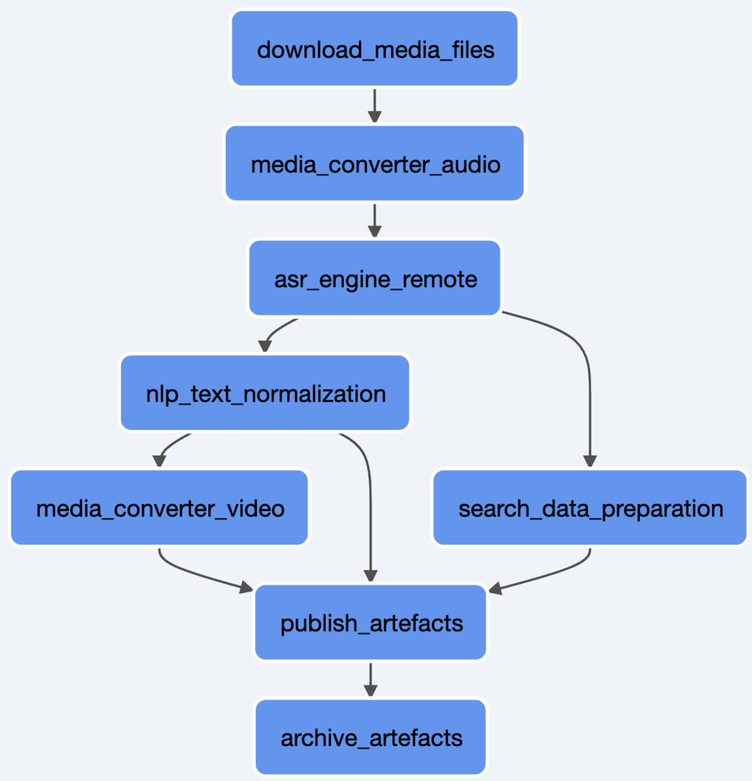

Figure: HAnS Apache Airflow direct acyclic graph.

Automatic Speech Recognition (ASR)

- The video is transcribed by the following ASR components:
  - Kaldi (tuda-de model) via Mod9 ASR Engine
  - Whisper

Natural Language Processing (NLP)

- ASR result is combined with the following NLP components:
  - Multilingual transformer to predict punctuation
  - Spacy for capitalization

Outlook

- Improve Automatic Speech Recognition
  - Out of vocabulary words
  - Recognition of technical terms using lecture slides
  - Mitigate biases
- Improve Natural Language Processing
  - Detection of topics and sub-topics
  - Summarize topic sections for search engine
- HAnS frontend and backend
  - Adapt user interface for topics and sub-topics
  - Integration of LMS Moodle
- Qualitative & Quantitative Evaluation by EVHN & THOWL
- AI-Tutor to automatically generate learning assessments

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