Deep Video Analytics

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Brief history of Computer Vision
In
Datasets & Libraries

Libraries & Datasets

- OpenCV
- ROS
- Caffe (model zoo!), Theano
- Torch
- Tensor Flow

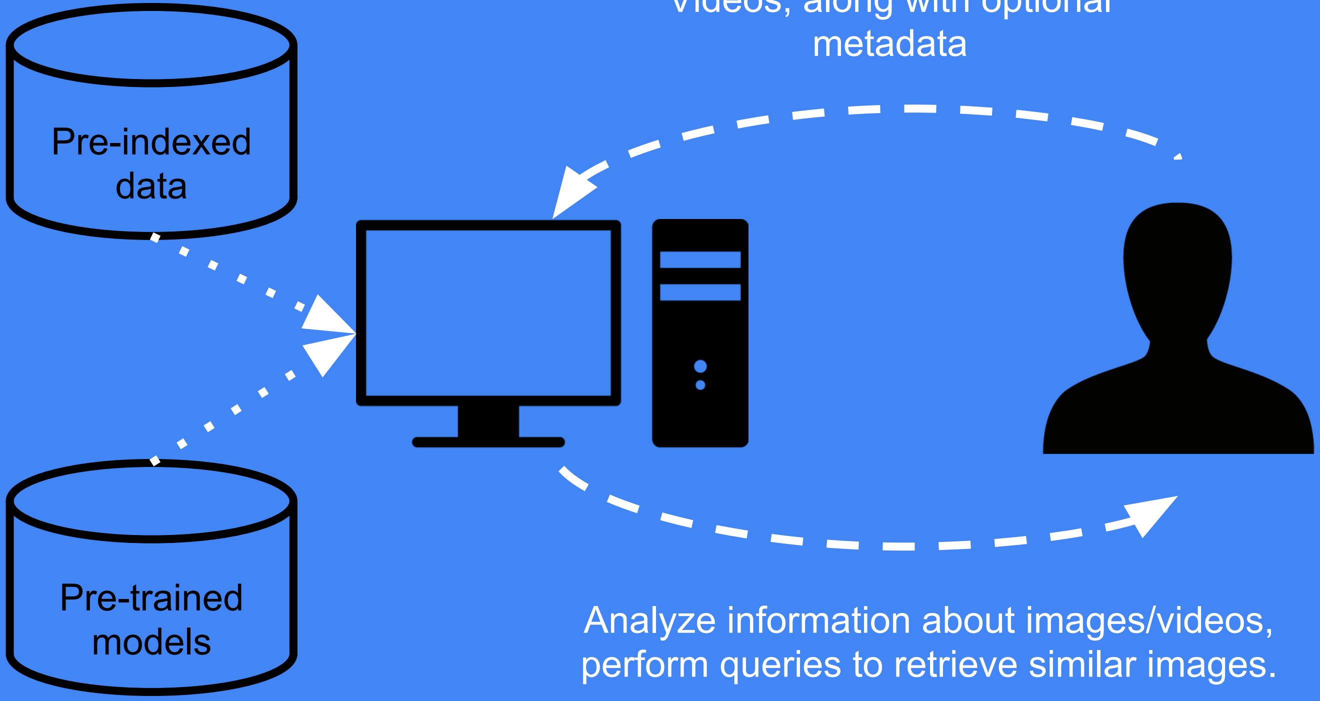
- Caltech 101
- Imagenet
- COCO
- Too many to keep track!
  - Youtube 8M, Open Images
  - Soundnet
  - Mapnet
  - CMU Video patch dataset

Gains in accuracy have enabled end user applications

There is a need for a platform which seamlessly combines Data + Models + User Interface

Some attempts at building a platform CloudCV & NVidia DIGITS

- **CloudCV**
  - CloudCV: Large Scale Distributed Computer Vision as a Cloud Service
  - Generic system Intended for researchers, and non-researchers
  - Support for OpenCV, Graphlab, Caffe
  - Image Classification, VQA, Image stitching and several other algorithms
- **NVidia DIGITS**
  - ”DIGITS (the Deep Learning GPU Training System) is a webapp for training deep learning models. ”
  - Load/create datasets, train models, deploy models.
  - Aimed at researchers
  - Written in Python/Flask with Torch & Caffe supported



Pre-indexed data

Pre-trained models

Provides Images & Videos, along with optional metadata

Analyze information about images/videos, perform queries to retrieve similar images.

Relational data : Postgres, MYSQL, SQLite

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Text, HTML : Lucene/Solr, Elasticsearch

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Videos & Images : ____________________

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Videos & Images : ***Deep Video Analytics***

Relational data : SQL

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Text, HTML : inverted word index, Page Rank

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Videos & Images : ***Approximate Nearest Neighbor***

Question

Why not modify just lucene to index images as vectors?

Answer

Visual Search is significantly different compared to full text search. It requires a new user interface and ability to handle detections, segmentations, videos, etc.

Deep Video Analytics

Visual Search as a “Primary User Interface”

- Intended for **non-researchers**
- Make it easy for users provide data (uploads, youtube-dl, etc.)
- Batteries-included approach with an indexing and detection pipeline
  - Tensor Flow Inception v3
  - Single Shot Detector trained on VOC & YOLO 9000
  - Face detection / alignment / recognition
  - More algorithms such Text detection, Audio features planned.
- Pre-indexed datasets from different domains can be quickly loaded
- Can be easily customized by developers & researchers.

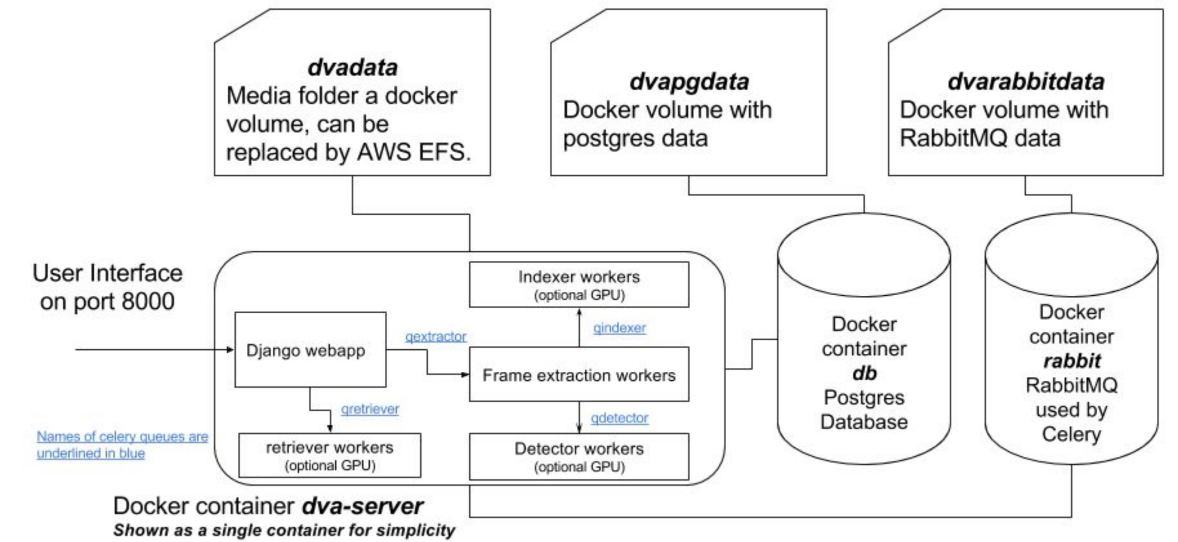
Technical requirements

- Should work on machines with and without GPUs
- Should allow uploads and reindexing operations
- Easy to adapt by technical users
- Easy to dynamically scale out using cloud computing

Datacenter on a machine

Docker, Docker-compose, Nvidia-docker

Docker enables same codebase across all configurations {a laptop, multi-GPU machine, datacenter} .



dvadata
Media folder a docker volume, can be replaced by AWS EFS.
dvapgdata
Docker volume with postgres data
dvarabbitdata
Docker volume with RabbitMQ data
User Interface on port 8000
Django webapp
qextractor
Indexer workers (optional GPU)
qindexer
Frame extraction workers
qretriever
qdetector
retriever workers (optional GPU)
Detector workers (optional GPU)
Names of celery queues are underlined in blue
Docker container ***db*** Postgres Database
Docker container ***rabbit*** RabbitMQ used by Celery
Docker container ***dva-server***
Shown as a single container for simplicity

Several open questions:
A work in progress

- How to balance fast/static vs slow/dynamic indexes?
- How to rank results using auxiliary information?
- How to incorporate text data extracted from images?
- Can we create a real time plug-in?
- Can the system continuously learn new categories?
- How do we incorporate external (pre & un) indexed data?

Thanks!

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