ModelHub.AI: Dissemination Platform for Deep Learning Algorithms

www.modelhub.ai
Nothing to declare.
The Great Leap

Annually Published AI Papers

Growth of Annually Published Papers

Source: Scopus.com

Yoav Shoham, Raymond Perrault, Erik Brynjolfsson, Jack Clark & Calvin LeGassick

Artificial Intelligence Index 2017

One Hundred Year Study on AI at Stanford University (AI100)
Deep Learning

Predefined engineered features + traditional machine learning

Feature engineering

Histogram

Texture

Expert knowledge

Shape

Selection

Classification

Deep learning

Input

Hidden layers

Increasingly higher-level features

Output

Convolution layers for feature map extraction

Pooling layers for feature aggregation

Fully connected layers for classification

Ahmed Hosny, Chintan Parmar, John Quackenbush, Lawrence H Schwartz and Hugo JWL Aerts

Artificial Intelligence in Radiology

Nature Reviews Cancer - 2018
Deep Learning

GitHub Stars of AI Software Libraries

Source: GitHub Archive

Artificial Intelligence Index 2017

Yoav Shoham, Raymond Perrault, Erik Brynjolfson, Jack Clark & Calvin LeGassick

One Hundred Year Study on AI at Stanford University (AI100)
Reproducibility

Code break

In a survey of 400 artificial intelligence papers presented at major conferences, just 6% included code for the papers’ algorithms. Some 30% included test data, whereas 54% included pseudocode, a limited summary of an algorithm.

Matthew Hutson

Artificial Intelligence Faces Reproducibility Crisis
Science - 2018

Christian Collberg and Todd A Preszler

Repeatability in Computer Systems Research
Communications of the ACM - 2016
Reproducibility

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## Existing Solutions

<table>
<thead>
<tr>
<th>Repository</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>bnvc_alxenet</td>
<td>Update bnvc_alxenet model</td>
<td>4 months ago</td>
</tr>
<tr>
<td>bnvc_googlenet</td>
<td>Add the value_info.json for the remaining of the models except style ...</td>
<td>3 months ago</td>
</tr>
<tr>
<td>bnvc_reference_caffeNet</td>
<td>Add the value_info.json for the remaining of the models except style ...</td>
<td>3 months ago</td>
</tr>
<tr>
<td>bnvc_reference_rccm_lite13</td>
<td>Add the value_info.json for the remaining of the models except style ...</td>
<td>3 months ago</td>
</tr>
<tr>
<td>densenet121</td>
<td>Add DenseNet-121 model</td>
<td>4 months ago</td>
</tr>
<tr>
<td>detectron</td>
<td>Add Detectron2_e2e_faster_rcnn_R-50-C4_2x model</td>
<td>3 months ago</td>
</tr>
<tr>
<td>inception_v1</td>
<td>Add Inception models</td>
<td>4 months ago</td>
</tr>
<tr>
<td>inception_v2</td>
<td>Add Inception models</td>
<td>4 months ago</td>
</tr>
<tr>
<td>resnet50</td>
<td>Add ResNet-50 model</td>
<td>4 months ago</td>
</tr>
<tr>
<td>scripts</td>
<td>Add Detectron2_e2e_faster_rcnn_R-50-C4_2x model</td>
<td>3 months ago</td>
</tr>
<tr>
<td>squeezeNet</td>
<td>Correct SqueezeNet value_info to 227x227</td>
<td>3 months ago</td>
</tr>
<tr>
<td>style_transfer</td>
<td>Add other style transfer models</td>
<td>4 months ago</td>
</tr>
<tr>
<td>vgg19</td>
<td>Add VGG models</td>
<td>4 months ago</td>
</tr>
<tr>
<td>znet512</td>
<td>Rename ZFNet to ZFNet-512 (#36)</td>
<td>11 hours ago</td>
</tr>
<tr>
<td>gitattributes</td>
<td>Remove squeezeNet-specific lines from .gitattributes</td>
<td>4 months ago</td>
</tr>
<tr>
<td>LICENSE</td>
<td>Add Apache 2.0 license</td>
<td>4 months ago</td>
</tr>
<tr>
<td>README.md</td>
<td>Update README to describe subdirectory access</td>
<td>3 months ago</td>
</tr>
</tbody>
</table>

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Yangqing Jia, Evan Shelhamer, Jeff Donahue, et al.

Caffe: Convolutional Architecture for Fast Feature Embedding

Existing Solutions

Samim and GraphiFic

GitXiv—Collaborative Open Computer Science
gitxiv.com
Existing Solutions

niftynet.io

dltk.github.io

dlhub.org
Existing Solutions

- [github.com/faustomilletari/tomaat](https://github.com/faustomilletari/tomaat)
- [deepinfer.org](https://deepinfer.org)
- [kipoi.org](https://kipoi.org)
Components

- Scientific
- Intuitive
- Open-source
- Portable
- Tool agnostic
Contribution

1. build docker image
   runtime environment

2. populate template
   model contribution

3. run tests
   modelhub integration tests

4. publish
   modelhub registry updates
Contribution - Docker

- Model source (template)
- MH engine + runtime
- Model runtime

- Image 1 (e.g., cntk:1.0.0)
- Image 2 (e.g., cntk-modelhub:1.0.0)
- Image 3 (e.g., cntk-modelhub-prod:1.0.0)

Operating system (e.g., Ubuntu)

Increasing volatility
Consumption – Frontend

app.modelhub.ai
### Consumption – APIs

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Method</th>
<th>Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>/get_config</td>
<td>GET</td>
<td>model configuration including metadata, manuscript information, model input/output formats and dimensions</td>
</tr>
<tr>
<td>/get_legal</td>
<td>GET</td>
<td>model and sample data license information</td>
</tr>
<tr>
<td>/get_model_files</td>
<td>GET</td>
<td>zip folder containing model and associated files</td>
</tr>
<tr>
<td>/get_samples</td>
<td>GET</td>
<td>urls to sample data</td>
</tr>
<tr>
<td>/predict_sample</td>
<td>GET</td>
<td>inference result on sample data</td>
</tr>
<tr>
<td>/predict</td>
<td>GET/POST</td>
<td>inference result on input provided through url (GET) or upload (POST), model metadata, processing time</td>
</tr>
</tbody>
</table>
# Consumption – Data Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>label_list</td>
<td>probabilities within json response</td>
<td></td>
</tr>
<tr>
<td>contour</td>
<td>list(s) of coordinates within json response</td>
<td></td>
</tr>
<tr>
<td>vector</td>
<td>1D vector XXXX</td>
<td></td>
</tr>
<tr>
<td>mask_image</td>
<td>≥2D. Single/multi-channel. Discrete. h5 (overlay)</td>
<td></td>
</tr>
<tr>
<td>heatmap</td>
<td>≥2D. Single/multi-channel. Continuous. h5 (overlay)</td>
<td></td>
</tr>
<tr>
<td>image</td>
<td>≥2D. Single/multi-channel. Continuous. h5</td>
<td></td>
</tr>
</tbody>
</table>
Welcome to Modelhub's documentation!

Crowdsourced through contributions by the scientific research community, Modelhub is a repository of deep learning models pretrained for a wide variety of medical applications. Modelhub highlights recent trends in deep learning applications, enables transfer learning approaches and promotes reproducible science.

Note

This documentation should contain all essential technical information about the Modelhub project and how to contribute models. It is, however, still work-in-progress, so possibly you need to be a little patient and persistent. If you find anything unclear, need help, or have suggestions, please feel free to contact us at "info@modelhub.ai".

Contents:

- Quick Start
- Overview
  - Framework
  - Repository Structure
- Contribute Your Model to Modelhub
  - Prerequisites
  - 1. Prepare Docker image
  - 2. Prepare your model based on the modelhub template
  - 3. Test your model
  - 4. Publish
Final notes

Limitations
- only supports inference
- designed for packaging and distribution
- dependent on Docker
- model serving is self-service

Moving forward
- expanding the model registry (in both breadth and depth) to enable meta-analysis
- support for more input (beyond images) and output data types
- simplifying the contribution process (entirely through a web browser)
- models as intellectual scholarly articles
The Team

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Harvard Medical School

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Intelligent Systems

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Udo Hoffmann
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Harvard Medical School

Spyridon Bakas
Perelman School of Medicine,
University of Pennsylvania

COVERALLS
Read the Docs
React
aws
Travis CI
docker
co-authorship through model contributions
Thank you!