MedMNIST Classification Decathlon: A Lightweight AutoML Benchmark for Medical Image Analysis

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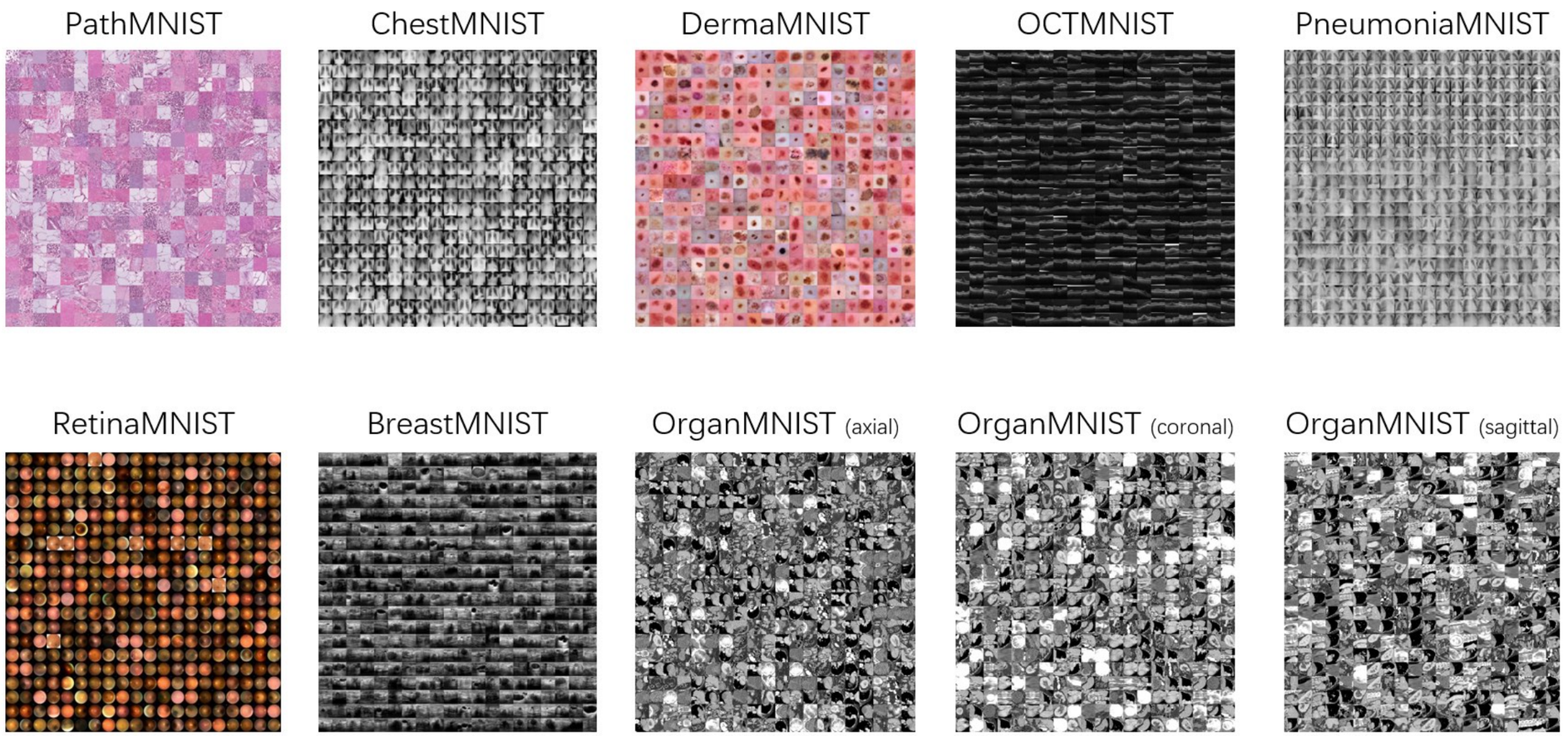


Abstract

We present MedMNIST, a collection of 10 pre-processed medical open datasets. MedMNIST is standardized to perform classification tasks on lightweight 28 * 28 images, which requires no background knowledge. Covering the primary data modalities in medical image analysis, it is diverse on data scale (from 100 to 100,000) and tasks (binary/multi-class, ordinal regression and multi-label). MedMNIST could be used for educational purpose, rapid prototyping, multi-modal machine learning or AutoML in medical image analysis. Moreover, MedMNIST Classification Decathlon is designed to benchmark AutoML algorithms on all 10 datasets; We have compared several baseline methods, including open-source or commercial AutoML tools.

Key Features

- **Educational**: Our multi-modal data, from multiple open medical image datasets with Creative Commons (CC) Licenses, is easy to use for educational purpose.
- **Standardized**: Data is pre-processed into same format, which requires no background knowledge for users.
- **Diverse**: The multi-modal datasets covers diverse data scales (from 100 to 100,000) and tasks (binary/multiclass, ordinal regression and multi-label).
- **Lightweight**: The small size of 28 × 28 is friendly for rapid prototyping and experimenting multi-modal machine learning and AutoML algorithms.

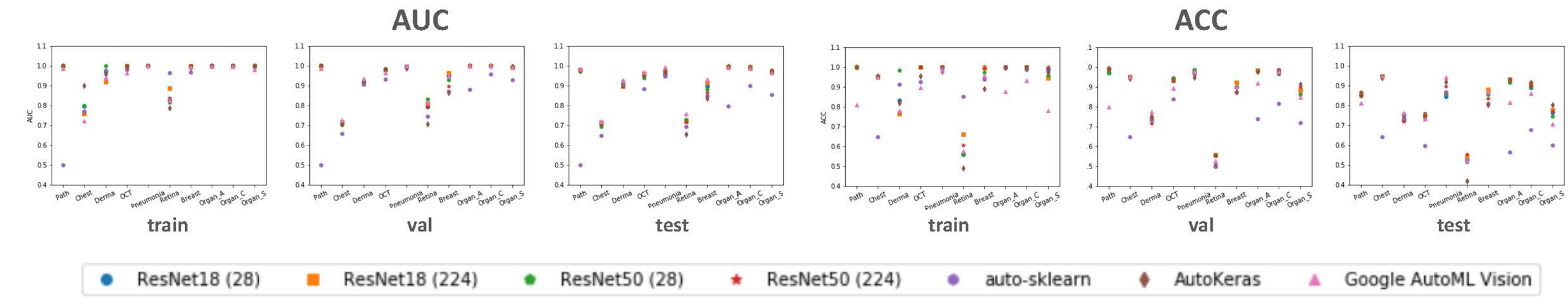
  Please note that this dataset is **NOT** intended for clinical use.

Materials

An Overview of MedMNIST Dataset

Name	Data Modality	Tasks (# Classes/Labels)	# Training	# Validation	# Test
PathMNIST	Pathology	Multi-Class (9)	89,996	10,004	7,180
ChestMNIST	Chest X-ray	Multi-Label (14) Binary-Class (2)	78,468	11,219	22,433
DermaMNIST	Dermatoscope	Multi-Class (7)	7,007	1,003	2,005
OCTMNIST	OCT	Multi-Class (4)	97,477	10,832	1,000
PneumoniaMNIST	Chest X-ray	Binary-Class (2)	4,708	524	624
RetinaMNIST	Fundus Camera	Ordinal Regression (5)	1,080	120	400
BreastMNIST	Breast Ultrasound	Binary-Class (2)	546	78	156
OrganMNIST_Axial	Abdominal CT	Multi-Class (11)	34,581	6,491	17,778
OragnMNIST_Coronal	Abdominal CT	Multi-Class (11)	13,000	2,392	8,268
OrganMNIST_Sagittal	Abdominal CT	Multi-Class (11)	13,940	2,452	8,829

Performance Analysis



Download

You could download the dataset(s) via the following free accesses:

- **zenodo.org** (recommended): You could also use our code to download the datasets from zenodo.org automatically.
- **Google Drive**
- **百度网盘** (code: gx6i)

Citation and Licenses

If you find this project useful, please cite our paper as:
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title={MedMNIST Classification Decathlon: A Lightweight AutoML Benchmark for Medical Image Analysis},

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year={2020}
}

Besides, please cite the corresponding paper if you use any subset of MedMNIST. Each subset uses the **same license** as that of the source dataset.

PathMNIST

Jakob Nikolas Kather, Johannes Krisam, et al., "Predicting survival from colorectal cancer histology slides using deep learning: A retrospective multicenter study," PLOS Medicine, vol. 16, no. 1, pp. 1–22, 01 2019.

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ChestMNIST

Xiaosong Wang, Yifan Peng, et al., "Chestx-ray8: Hospital-scale chest x-ray database and benchmarks on weakly-supervised classification and localization of common thorax diseases," in CVPR, 2017, pp. 3462–3471.

License: *CC0 1.0*

DermaMNIST

Philipp Tschandl, Cliff Rosendahl, and Harald Kittler, "The ham10000 dataset, a large collection of multisource dermatoscopic images of common pigmented skin lesions," Scientific data, vol. 5, pp. 180161, 2018.

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OCTMNIST/PneumoniaMNIST

Daniel S. Kermany, Michael Goldbaum, et al., "Identifying medical diagnoses and treatable diseases by image-based deep learning," Cell, vol. 172, no. 5, pp. 1122 – 1131.e9, 2018.

License: *CC BY 4.0*

RetinaMNIST

DeepDR Diabetic Retinopathy Image Dataset (DeepDRiD), "The 2nd diabetic retinopathy – grading and image quality estimation challenge," https://isbi.deepdr.org/data.html, 2020.

License: *CC BY 4.0*

BreastMNIST

Walid Al-Dhabyani, Mohammed Gomaa, Hussien Khaled, and Aly Fahmy, "Dataset of breast ultrasound images," Data in Brief, vol. 28, pp. 104863, 2020.

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OrganMNIST_{Axial,Coronal,Sagittal}

Patrick Bilic, Patrick Ferdinand Christ, et al., "The liver tumor segmentation benchmark (lits)," arXiv preprint arXiv:1901.04056, 2019.

Xuanang Xu, Fugen Zhou, et al., "Efficient multiple organ localization in ct image using 3d region proposal network," IEEE Transactions on Medical Imaging, vol. 38, no. 8, pp. 1885–1898, 2019.

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