DLL: MedNIST Exam Classification with MONAI

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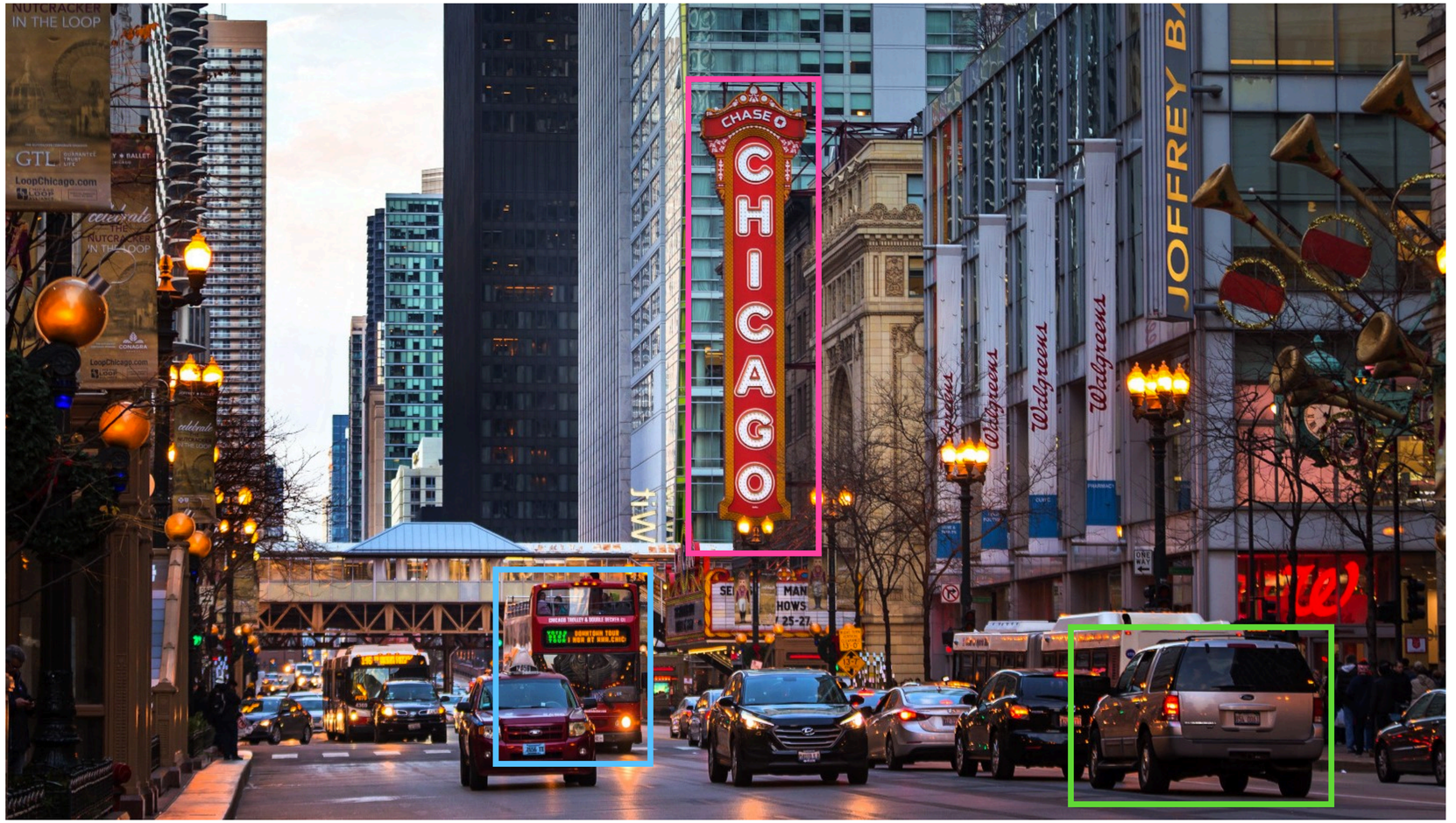
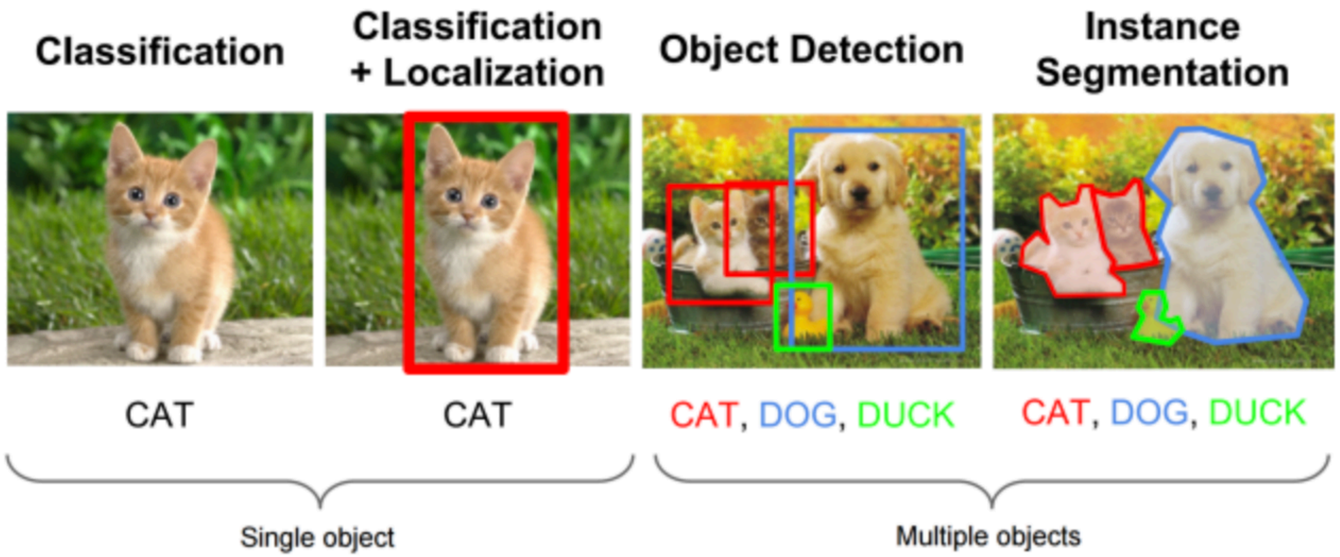
Vision

To discover from images what is present in the world, where things are, what actions are taking place, to predict and anticipate events in the world.



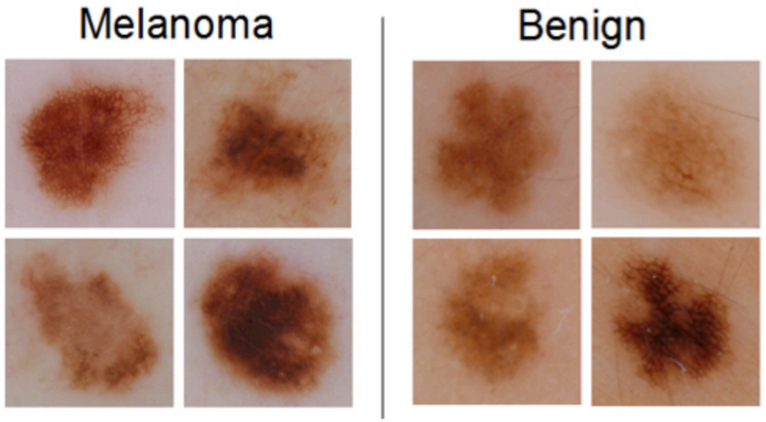
Computer vision

Deep learning computer vision tasks: Classification vs Detection vs Segmentation.

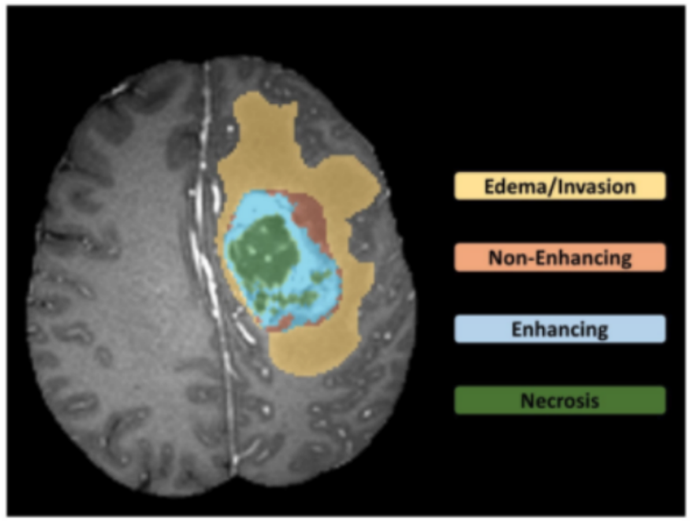


Computer vision in medicine

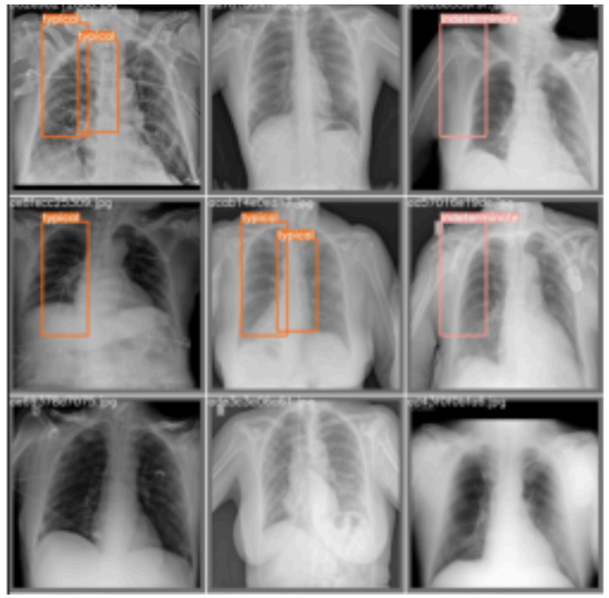
The goal of (computer vision) radiology applications is to improve the quality of care, and reduce the healthcare cost.



Skin cancer classification



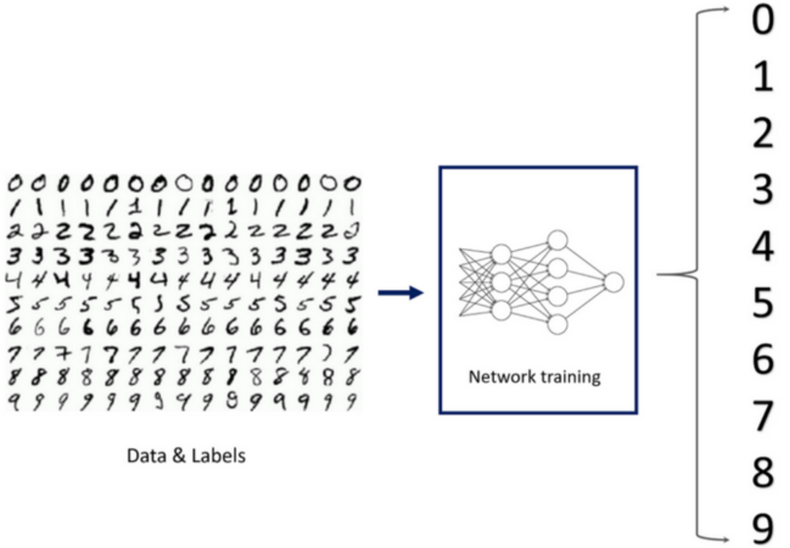
Tumor segmentation of GBM



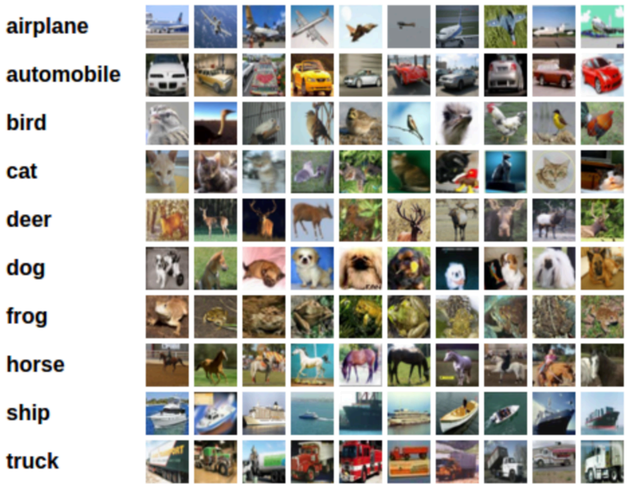
COVID-19 detection

Datasets

The MNIST database is a large database of handwritten digits that is widely used for training and testing ML computer vision algorithms.



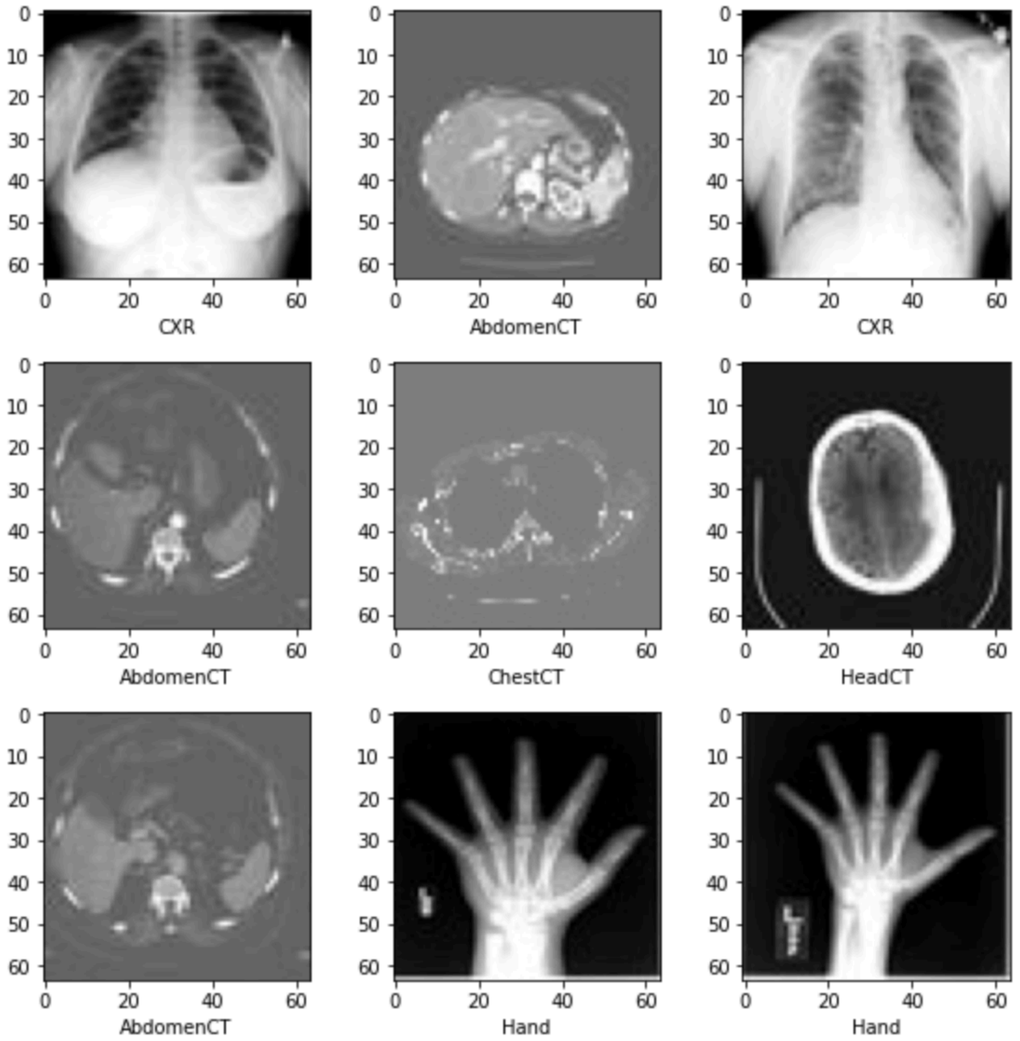
CIFAR10 dataset has classes such as ‘airplane’, ‘automobile’, ‘bird’, ‘cat’, ‘deer’, ‘dog’, ‘frog’, ‘horse’, ‘ship’, ‘truck’.



MedNIST dataset

The MedMNIST database are MRI, CT, X-ray images gathered from TCIA, the RSNA Bone Age Challenge, and the NIH Chest X-ray dataset.

There are 6 folders in the dataset: ‘Hand’, ‘AbdomenCT’, ‘CXR’, ‘ChestCT’, ‘BreastMRI’, and ‘HeadCT’. Data counts are respectively, 10000, 10000, 10000, 10000, 8954, and 10000.



The model

Why convolutional neural networks (CNN)?

- For Images with 28×28 pixels in greyscale, 784 ($28 \times 28 \times 1$) neurons is needed to build a fully connected layer. However, for clinical scans such as brain MRI, we would need 33,554,432 ($512 \times 512 \times 128$) different neurons connected to each other in the first layer which is not really manageable.
- When it comes to images, there seems to be little correlation or relation between two individual pixels unless they are close to each other.

Why MONAI?

- Designed specifically for healthcare imaging tasks.
- Open-source deep learning framework based on Pytorch.
- Especially useful for data pre-processing and augmentations.

Flowchart of the notebook

Part 1: Install packages and get the dataset

‘Hand’, ‘AbdomenCT’, ‘CXR’, ‘ChestCT’, ‘BreastMRI’, and ‘HeadCT’

Part 2: Create datasets & Pre-process with MONAI

Training, val, test datasets & Dataset and Dataloader & Monai transforms

Part 3: Define the model & perform the training

DenseNet from Monai.networks & training circles

Part 4: Evaluate the best-metric model

Thank you!

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