COCO-API

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OverView

As we all know, the COCO2014/2017 dataset is widely used for object detection, instance segmentation, image description, key point detection, panoramic segmentation and many other tasks, the official has provided cocoapi's python, matlab, lua language interface, but in matlab using the interface provided by the program is very poor readability, not easy to intuitively clear, the use of people This program makes full use of the characteristics of the table type to enrich the expression of coco datasets, with only about 100 lines of code to achieve the "instances", "keypoints" ,"captions" level of API, without any third-party libraries, can be customized to modify the API, code readability.

众所周知，COCO2014/2017 数据集被广泛用于目标检测、实例分割、图像描述、关键点检测、全景分割等多种任务，官方已提供 cocoapi 的 python、matlab、lua 语言的接口，但在 matlab 中使用其提供的接口程序可读性非常差，不易直观清晰，使用的人较少，本程序充分利用 table 类型的特性，丰富展示 coco 数据集的表达，仅用 100 行左右代码实现了“instances”、“keypoints”、“captions”级别的 API，无需任何第三方库，可二次自定义修改 API，代码可读性强。

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Syntax

[allCOCOdata,cocoDatastore,cocoNames] = cocoInstancesAPI(imagesDir,annotationFile,categoryNames)

功能：优雅的实现 coco2014，coco2017 数据集 instances 新接口

输入：

imagesDir，string 类型，1*1 大小，输入 COCO 图像文件根目录

annotationFile，string 类型，1*1 大小，与之对应的标注 json 文件

categoryNames，（可选项）string 类型，1*N 大小，物体类别，默认所有类别

输出：

allCOCOdata，table 类型，所有带有标注的完整信息，每行代表一副图像

cocoDatastore，TransformedDatastore object，可就地迭代对象

cocoNames，categorical 类型，80 个类别

[allCOCOdata,cocoDatastore,keyPtsNames,skeleton] = cocoKeyPointsAPI(imagesDir,annotationFile)

功能：优雅的实现 coco2014，coco2017 数据集 keypoints 新接口

输入：

imagesDir，string 类型，输入 COCO 图像文件根目录

annotationFile，string 类型，与之对应的标注 json 文件

输出：

allCOCOdata， table 类型，所有带有标注的完整信息，每行代表一副图像

cocoDatastore，TransformedDatastore object，可就地迭代对象

keyPtsNames，categorical 类型数组，长度为 17，分别为人体各个部位 id 顺序名字

skeleton，double 类型数组，M*2 大小，人体部位各个 id 连接情况，第一列与第二列 id 进行连接

[allCOCOdata,cocoDatastore] = cocoCaptionsAPI(imagesDir,annotationFile)

功能：优雅的实现 coco2014，coco2017 数据集 Captions 新接口

输入：

imagesDir，string 类型，输入 COCO 图像文件根目录

annotationFile，string 类型，与之对应的标注 json 文件

输出：

allCOCOdata， table 类型，所有带有标注的完整信息，每行代表一副图像

cocoDatastore，TransformedDatastore object，可就地迭代对象

Requirements

- MatlabR2020b or higher
- coco2014 or 2017 datasets (images and annotations)

How to use

一般做 object detection/segmention/keypoints/captions,训练任务都会用到可迭代的 datasets，比如对上述三类 API 返回数据 cocoDatastore 进行迭代使用，read 会从内存中读取部分数据，读取的数据直观上应当有以下返回形式数据格式：

data = read(cocoDatastore)

根据不同任务的 API，返回元胞数组 data 中的元素有如下直观形式。

- RGB images (H x W x 3)
- Bounding boxes (NumObjects x 4, arranged as [x y w h])
- Labels (NumObjects x 1), categorical
- Masks (H x W x NumObjects)
- KeyPoints (17×3×NumObjects)
- Captions(NumSentences x 1 cell array)

Example1, instance

```
% coco path
imagesDir = '\\192.168.1.103\dataSets\coco2017\val2017\val2017';
annotationFile = '\\192.168.1.103\dataSets\coco2017\annotations_trainval2017\annotations\instan
yourNames = ["dog","cat"]; % optional
% coco-api
[allCOCOdata,cocoDatastore,coconames] = cocoInstancesAPI(imagesDir,...
    annotationFile,yourNames);

head(allCOCOdata) % preview,Get top rows of table
```

ans = 8×13 table

...

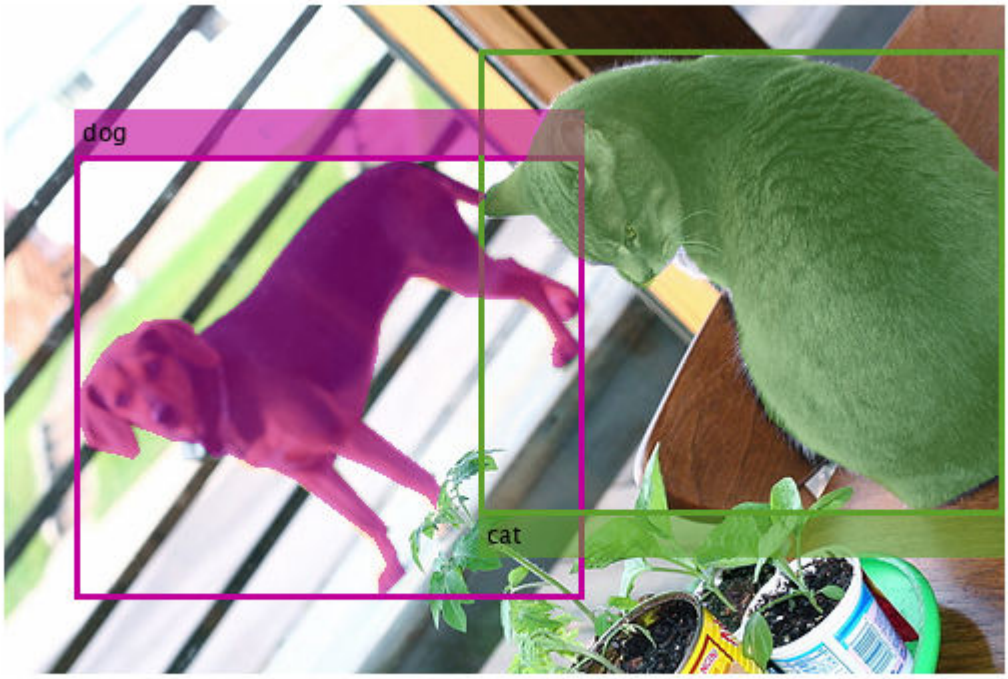
	image_id	license	file_name	coco_url	height	width	date_captured
1	1675	1	'000000001675.jpg'	'http://image...	480	640	'2013-11-18 00...
2	4795	1	'000000004795.jpg'	'http://image...	480	640	'2013-11-17 21...
3	7386	3	'000000007386.jpg'	'http://image...	400	600	'2013-11-15 12...
4	10363	1	'000000010363.jpg'	'http://image...	361	640	'2013-11-15 07...
5	14007	3	'000000014007.jpg'	'http://image...	426	640	'2013-11-24 11...
6	14831	1	'000000014831.jpg'	'http://image...	640	480	'2013-11-17 19...
7	15497	1	'000000015497.jpg'	'http://image...	480	640	'2013-11-18 00...
8	17029	4	'000000017029.jpg'	'http://image...	640	640	'2013-11-18 14...

```
colormap = randi(255,length(coconames),3);
cocoDatastore = shuffle(cocoDatastore); % random
while cocoDatastore.hasdata()
    data = read(cocoDatastore);
    img = data{1};  % origin image(H×W×C)
    bboxs = data{2}; % Bounding boxes (NumObjects x 4,  arranged as [x y w h])
    labels = data{3};% Labels (NumObjects x 1), categorical
    masks = data{4}; % Masks (H x W x NumObjects)

    colors = colormap(arrayfun(@(x)find(x==coconames),labels),:);
    draw = insertObjectAnnotation(img,'rectangle',bboxs,labels,...
        'LineWidth',3,...
        'Color',colors);
    for i = 1:size(masks,3)
        draw = labeloverlay(draw,masks(:,:,i),...
            'Colormap',colors(i,:)/255,...
            'Transparency' , 0.5);
```

```
    end

    imshow(draw)
    break;
end
```



Example2, keypoints

```
imagesDir='\\192.168.1.103\dataSets\coco2017\val2017\val2017';
annotationFile = '\\192.168.1.103\dataSets\coco2017\annotations_trainval2017\annotations\person
[allCOCOdata,cocoDatastore,keyPtsNames,skeleton] = ...
    cocoKeyPointsAPI(imagesDir,annotationFile);
head(allCOCOdata) % preview,Get top rows of table
```

ans = 8×12 table

...

	image_id	license	file_name	coco_url	height	width	date_captured
1	139	2	'000000000139.jpg'	'http://image...	426	640	'2013-11-21 01...
2	785	4	'000000000785.jpg'	'http://image...	425	640	'2013-11-19 21...
3	872	4	'000000000872.jpg'	'http://image...	640	621	'2013-11-23 00...
4	885	4	'000000000885.jpg'	'http://image...	427	640	'2013-11-21 02...
5	1000	4	'000000001000.jpg'	'http://image...	480	640	'2013-11-21 05...
6	1268	4	'000000001268.jpg'	'http://image...	427	640	'2013-11-17 05...

	image_id	license	file_name	coco_url	height	width	date_captured
7	1296	5	'000000001296.jpg'	'http://image...	640	427	'2013-11-24 08...
8	1353	3	'000000001353.jpg'	'http://image...	500	375	'2013-11-17 04...

```
cocoDatastore = shuffle(cocoDatastore); % random
while cocoDatastore.hasdata()
    data = read(cocoDatastore);
    img = data{1};   % origin image(H×W×C)
    bboxs = data{2}; % Bounding boxes (NumObjects x 4,  arranged as [x y w h])
    masks = data{3}; % Masks (H x W x NumObjects)
    keyPts = data{4}; % KeyPoints (17×3×NumObjects)

    % plot
    draw = insertObjectAnnotation(img,'rectangle',bboxs,"",...
        'LineWidth',3);
    for i = 1:size(masks,3)
        draw = labeloverlay(draw,masks(:,:,i));
    end
    draw = drawSkeleton(draw,keyPts,skeleton);

    imshow(draw)
    break;
end
```

Example3,captions

```
imagesDir = '\\192.168.1.103\dataSets\coco2017\val2017\val2017';
annFile = '\\192.168.1.103\dataSets\coco2017\annotations_trainval2017\annotations\captions_val2
[allCOCOdata,cocoDatastore] = cocoCaptionsAPI(imagesDir,annFile);
head(allCOCOdata) % preview,Get top rows of table
```

```
ans = 8×10 table
```

...

	image_id	license	file_name	coco_url	height	width	date_captured
1	139	2	'000000000139.jpg'	'http://image...	426	640	'2013-11-21 01...
2	285	4	'000000000285.jpg'	'http://image...	640	586	'2013-11-18 13...
3	632	3	'000000000632.jpg'	'http://image...	483	640	'2013-11-20 21...
4	724	1	'000000000724.jpg'	'http://image...	500	375	'2013-11-17 09...
5	776	1	'000000000776.jpg'	'http://image...	640	428	'2013-11-20 01...
6	785	4	'000000000785.jpg'	'http://image...	425	640	'2013-11-19 21...
7	802	6	'000000000802.jpg'	'http://image...	640	424	'2013-11-24 10...
8	872	4	'000000000872.jpg'	'http://image...	640	621	'2013-11-23 00...

```
cocoDatastore = cocoDatastore.shuffle();
while cocoDatastore.hasdata()
    data = read(cocoDatastore);
    img = data{1};   % origin image(H×W×C)
    captions = data{2}; % captions (NumSentences x 1 cell array)

    % caption
    draw = insertText(img,[1,5],strjoin(captions,'\n'));
    imshow(draw);
    break;
end
```

SupportFunction

```
function drawRGB = drawSkeleton(image,keyPts,skeleton)
% 功能：在输入图像 image 上绘制人体骨架图,只绘制标注过的点线
% 输入：
%    image
%            大小为 H*W*C，输入图像
%    keyPts
%             double 类型数组，大小为 17*3*NumObjects；17 个点，3 表示[x,y,flag]，
%             flag=0,表示这个关键点没有标注（这种情况下 x=y=flag=0），flag 为 1 时
%             表示这个关键点标注了但是不可见（被遮挡了），flag 为 2 时表示这个关键
%             点标注了同时也可见.
%   skeleton
%            double 类型数组，大小为 M*2,表示 coco 中 17 个点连接情况，数据表示 ID 序号
% 输出：
%     drawRGB
%            大小为 H*W*C，输出图像
%
% author:cuixingxing
% cuixingxing150@gmail.com
% 2021.8.11
%
arguments
    image
    keyPts (17,3,:) double
    skeleton (:,2) double
```

```
end
drawRGB = image;
Radus = 5;
numObjs = size(keyPts,3);
colormaps = randi(255,numObjs,3);
for i = 1:numObjs
    currentKPts = keyPts(:,:,i);% 17*3, [x,y,flag]
    validIdx = currentKPts(:,3)~=0;

    validKPts = currentKPts(validIdx,:);
    radius = Radus*ones(sum(validIdx),1);
    drawRGB = insertShape(drawRGB,...
        'FilledCircle',[validKPts(:,1:2),radius],...
        'Color','red');

    validID = find(validIdx);
    connectionValidID = ismember(skeleton(:,1),validID)&...
        ismember(skeleton(:,2),validID);
    connectionValid = skeleton(connectionValidID,:);
    x1 = currentKPts(connectionValid(:,1),1);
    y1 = currentKPts(connectionValid(:,1),2);
    x2 = currentKPts(connectionValid(:,2),1);
    y2 = currentKPts(connectionValid(:,2),2);
    lines = [x1,y1,x2,y2];
    drawRGB = insertShape(drawRGB,'Line',lines,...
        'Color',colormaps(i,:),...
        'LineWidth',2);
end
end
```

Reference

[1] coco-datasets

[2] COCO 数据集的标注格式