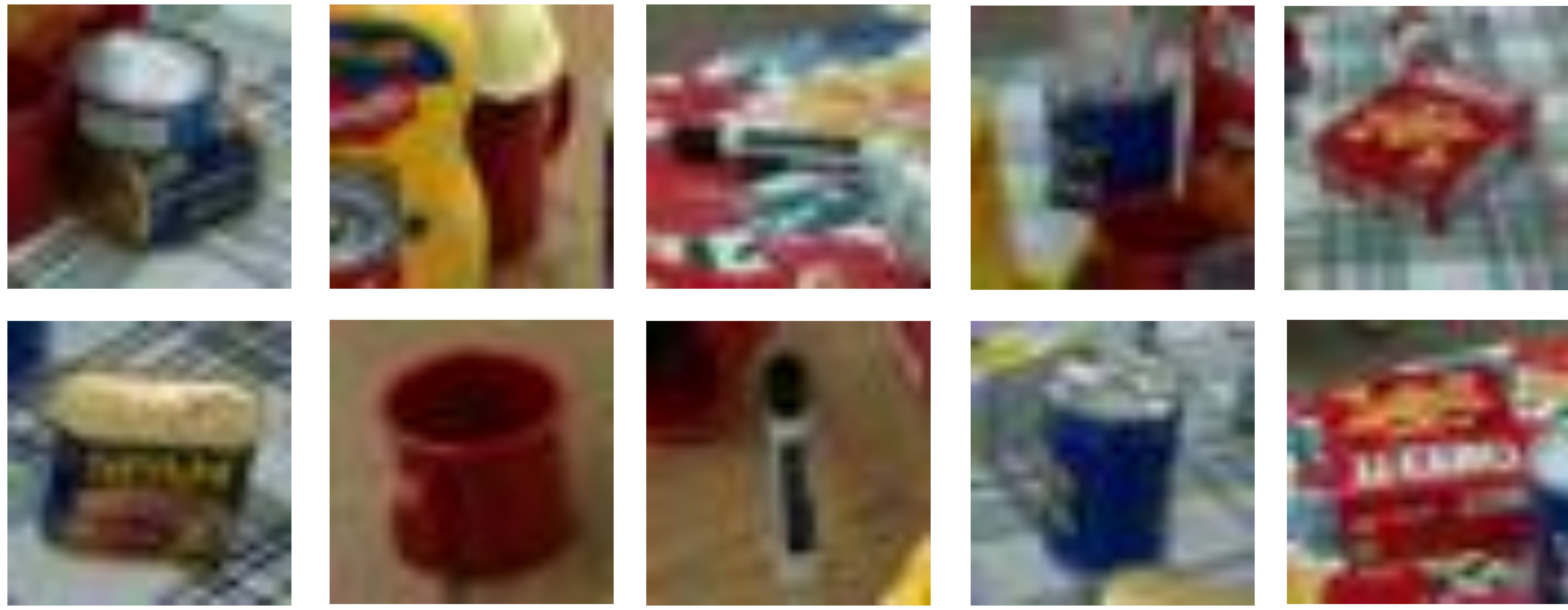


DeepRob

Discussion 2
Introduction to the PROPS Dataset
University of Michigan and University of Minnesota




Today's Agenda

- Administrative Announcements
- Introduction to Project 1
- Discussion of PROPS Dataset
- Troubleshooting

Administrative Announcements

- Project 1 is released
- Autograder roster updated
- Gradescope roster updated
- Slight revision to quiz policy
  - Quizzes to be open all morning on quiz days until start of lecture
  - 7:00AM EST until 3:00PM EST W
  - ill be announced again via email

Project 1—Introduction

- Objective
  - Gain experience building a machine learning pipeline to train and evaluate image classification models

- You will implement three image classifiers
  1. K-Nearest Neighbors
  2. Linear Softmax
  3. Linear SVM

Project 1—Logistics

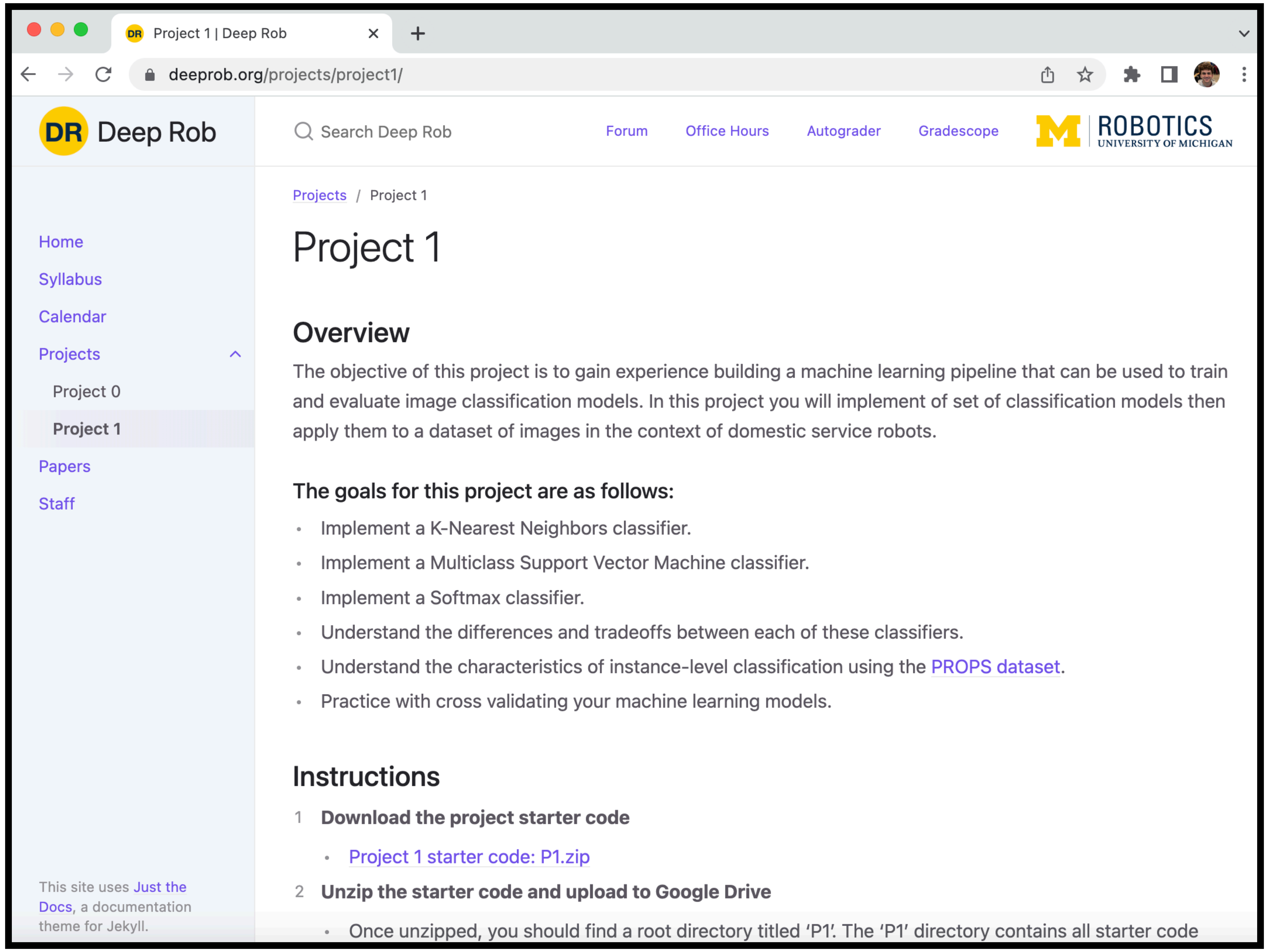
- Instructions and code available on the website
  - Here: deeprob.org/projects/project1/

- Uses Python, PyTorch and Google Colab

- **Autograder won't be online until this weekend**
  - It will be announced once online

- **Due Thursday, January 26th 11:59 PM EST**

Project 1 — Instructions



Project 1 | Deep Rob

deeprob.org/projects/project1/

Deep Rob

Search Deep Rob

Forum Office Hours Autograder Gradescope

ROBOTICS UNIVERSITY OF MICHIGAN

- Home
- Syllabus
- Calendar
- Projects
  - Project 0
  - Project 1
- Papers
- Staff

This site uses Just the Docs, a documentation theme for Jekyll.

Projects / Project 1

Project 1

Overview

The objective of this project is to gain experience building a machine learning pipeline that can be used to train and evaluate image classification models. In this project you will implement of set of classification models then apply them to a dataset of images in the context of domestic service robots.

The goals for this project are as follows:

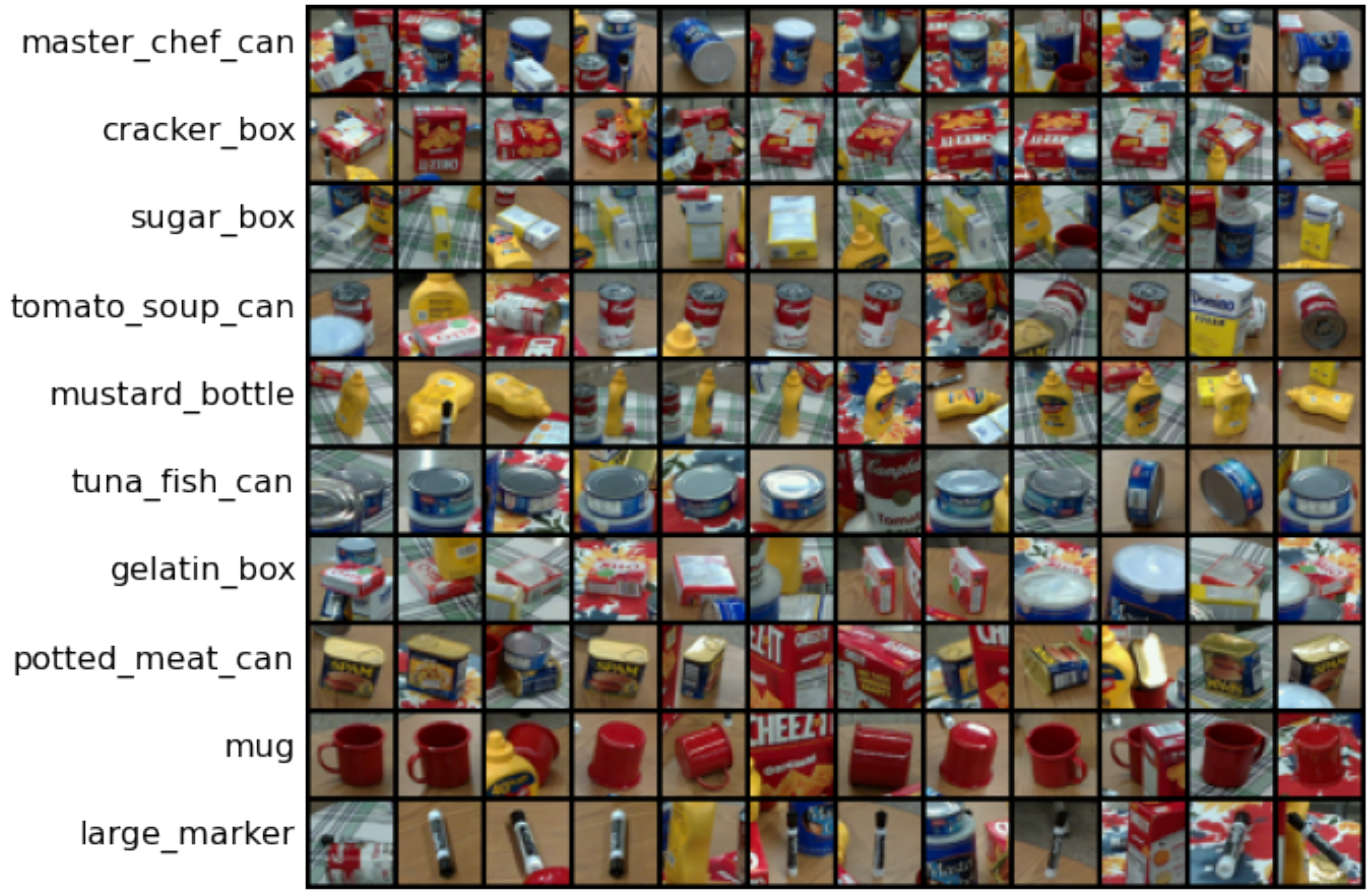
- Implement a K-Nearest Neighbors classifier.
- Implement a Multiclass Support Vector Machine classifier.
- Implement a Softmax classifier.
- Understand the differences and tradeoffs between each of these classifiers.
- Understand the characteristics of instance-level classification using the PROPS dataset.
- Practice with cross validating your machine learning models.

Instructions

1. **Download the project starter code**
   - Project 1 starter code: P1.zip
2. **Unzip the starter code and upload to Google Drive**
   - Once unzipped, you should find a root directory titled 'P1'. The 'P1' directory contains all starter code

Project 1 — Dataset

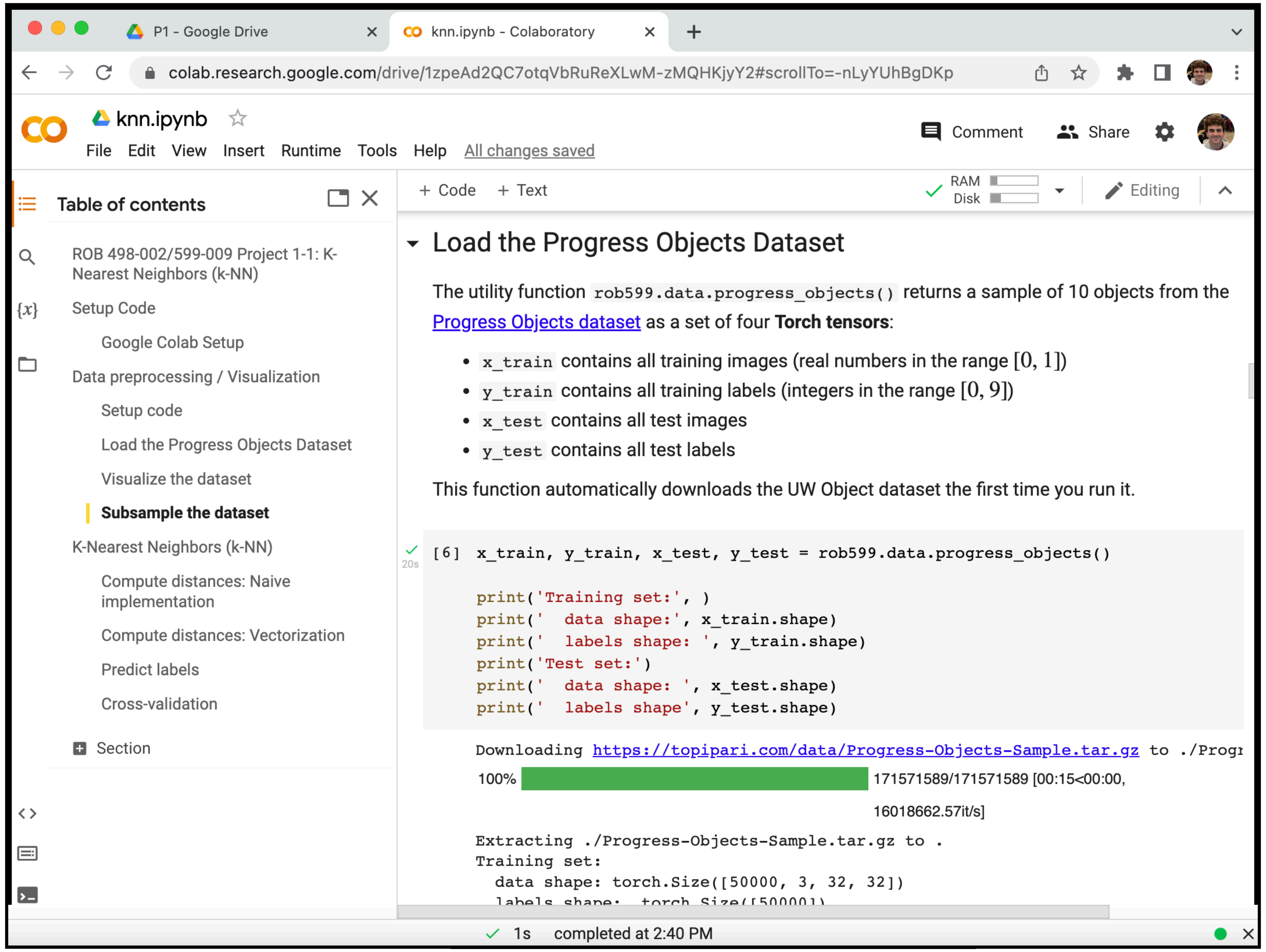
Progress **R**obot **O**bject **P**erception **S**amples **D**ataset



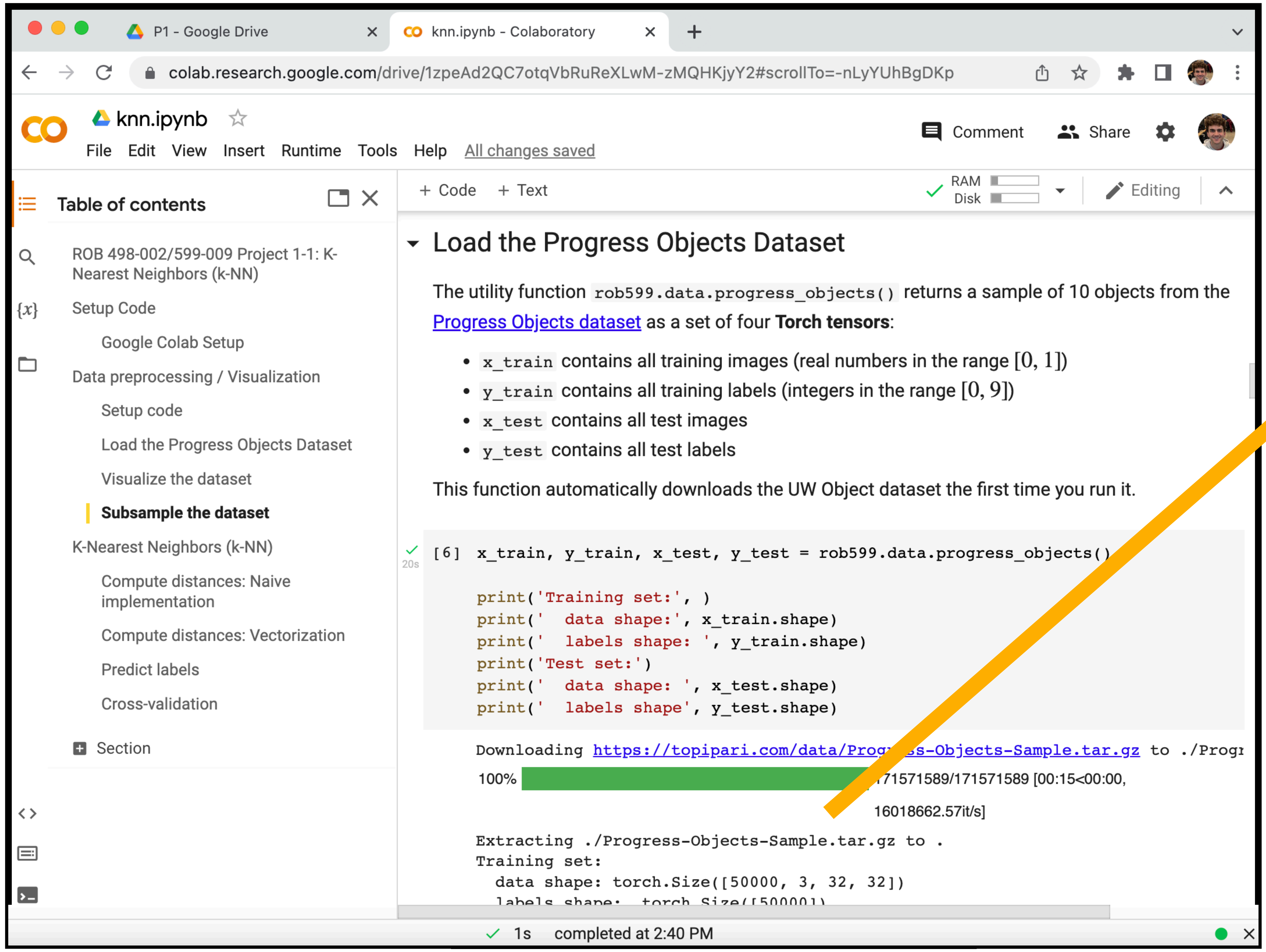
Chen et al., "ProgressLabeller: Visual Data Stream Annotation for Training Object-Centric 3D Perception", IROS, 2022.

10 classes
32x32 RGB images
50k training images (5k per class)
10k test images (1k per class)

Project 1—Setup & Preprocessing



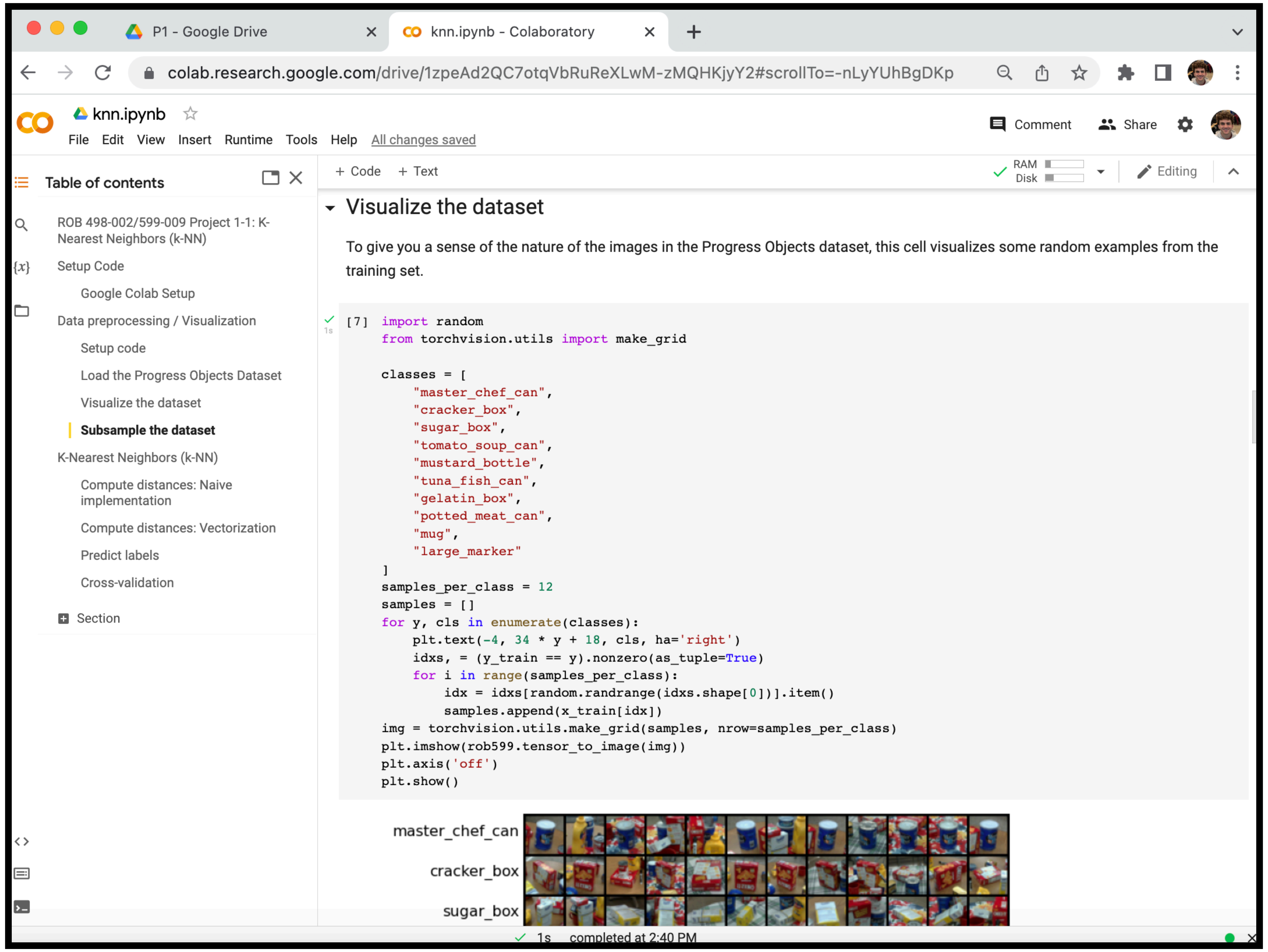
Project 1—Setup & Preprocessing




```
Extracting ./Progress-Objects-Sample.tar.gz to .
Training set:
  data shape: torch.Size([50000, 3, 32, 32])
  labels shape:  torch.Size([50000])
Test set:
  data shape:  torch.Size([10000, 3, 32, 32])
  labels shape torch.Size([10000])
```

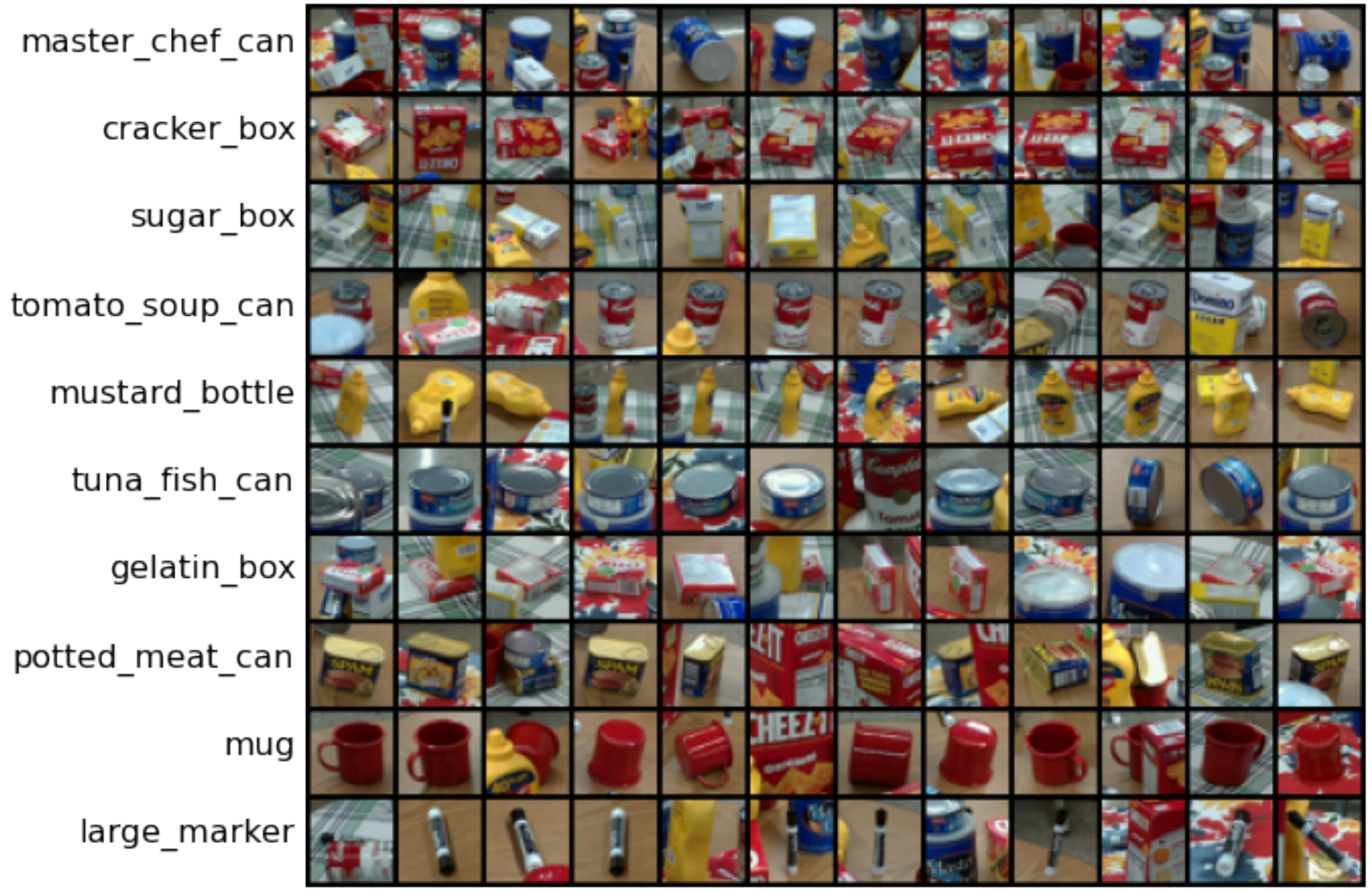
Verify size of train, test set

Project 1 — Dataset Visualization



Project 1—Dataset

Progress **R**obot **O**bject **P**erception **S**amples **D**ataset

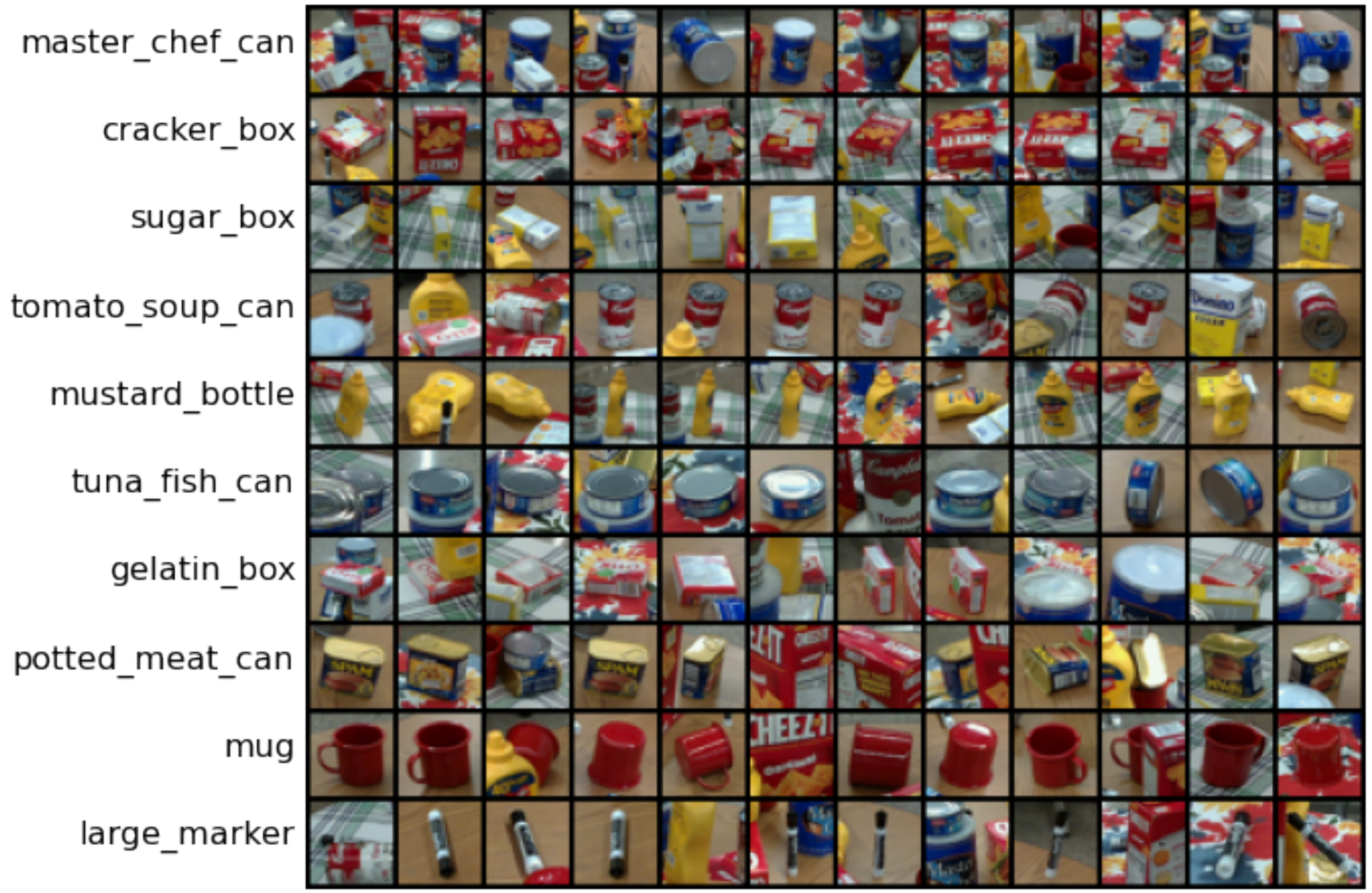


Chen et al., "ProgressLabeller: Visual Data Stream Annotation for Training Object-Centric 3D Perception", IROS, 2022.

10 classes
32x32 RGB images
50k training images (5k per class)
10k test images (1k per class)

Project 1—Dataset

Progress **R**obot **O**bject **P**erception **S**amples **D**ataset

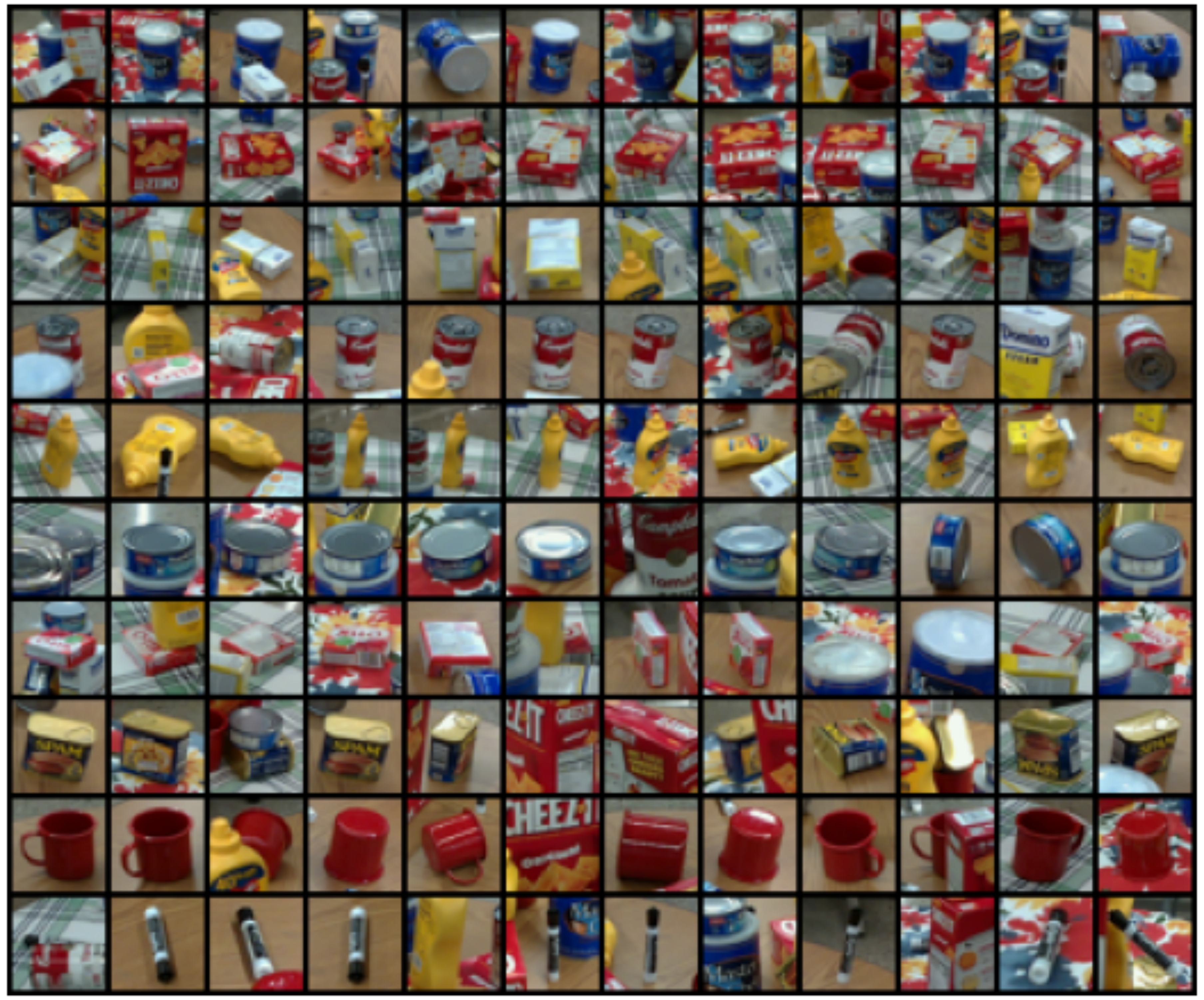


Chen et al., "ProgressLabeller: Visual Data Stream Annotation for Training Object-Centric 3D Perception", IROS, 2022.

10 classes
32x32 RGB images
50k training images (5k per class)
10k test images (1k per class)

What is the source of this data?

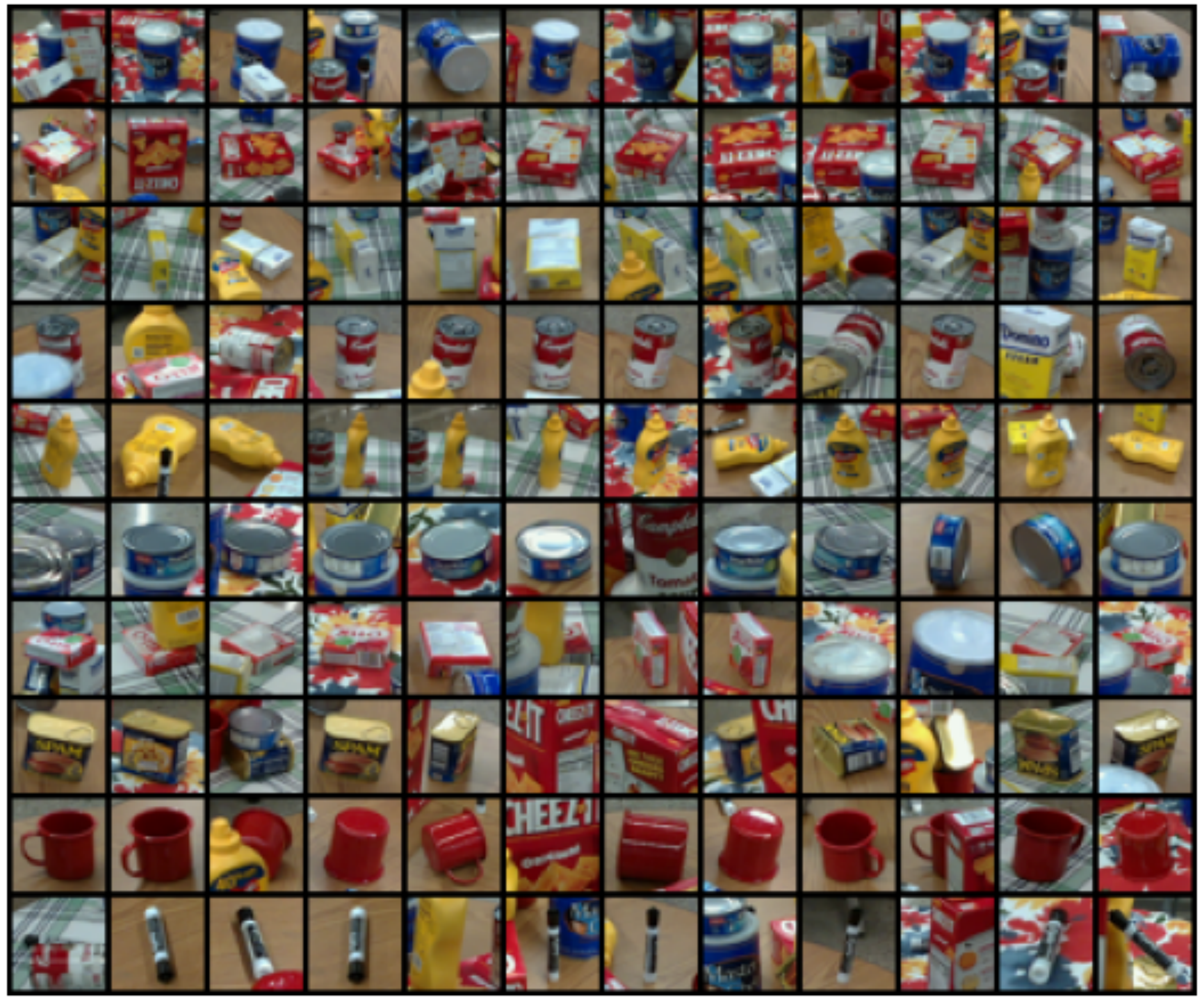
Labeling a Dataset



Chen et al., “ProgressLabeller: Visual Data Stream Annotation for Training Object-Centric 3D Perception”, IROS, 2022.

master_chef_can
cracker_box
sugar_box
tomato_soup_can
mustard_bottle
tuna_fish_can
gelatin_box
potted_meat_can
mug
large_marker

Labeling a Dataset



Chen et al., “ProgressLabeller: Visual Data Stream Annotation for Training Object-Centric 3D Perception”, IROS, 2022.

Human Annotator

master_chef_can

cracker_box

sugar_box

tomato_soup_can

mustard_bottle

tuna_fish_can

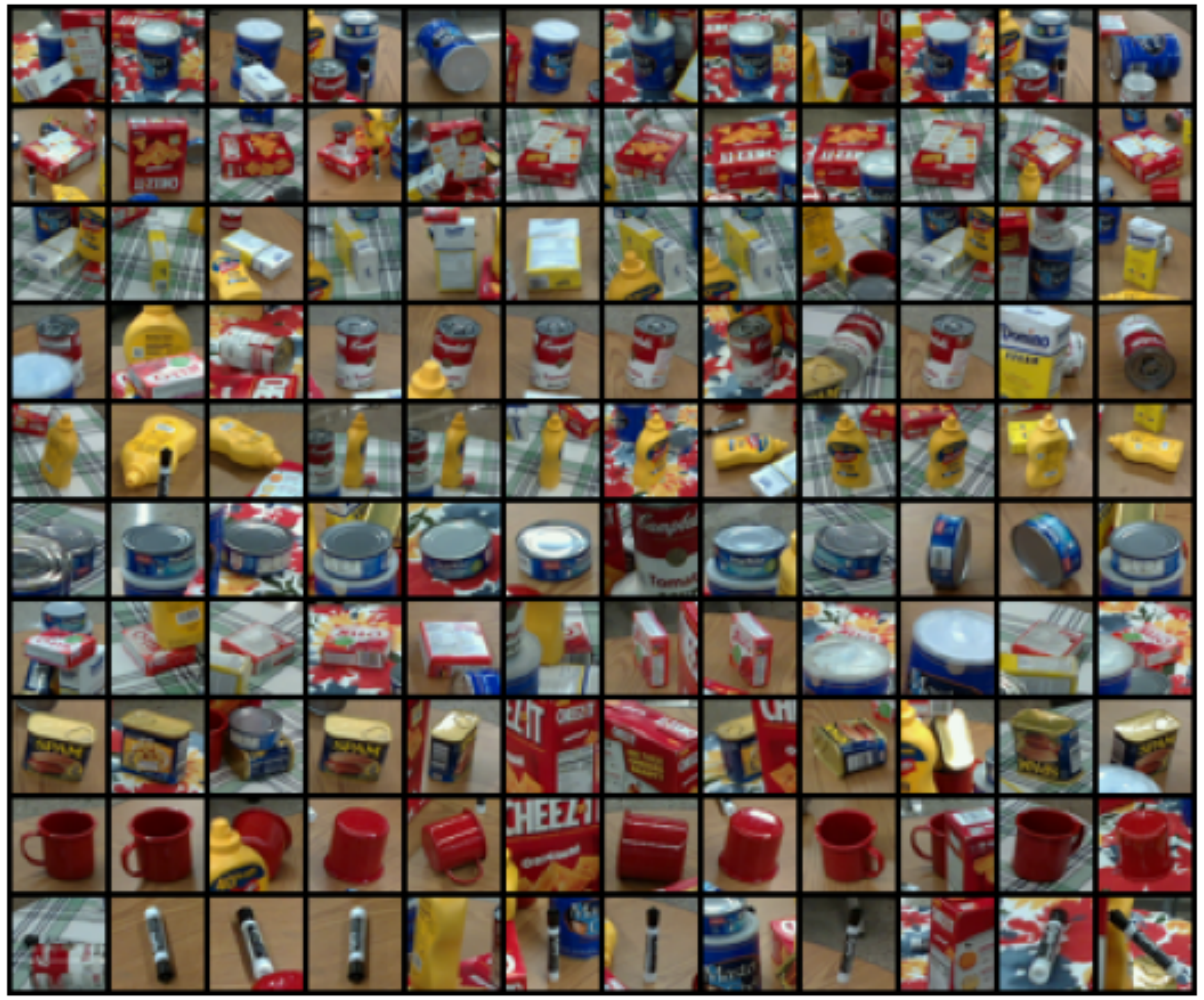
gelatin_box

potted_meat_can

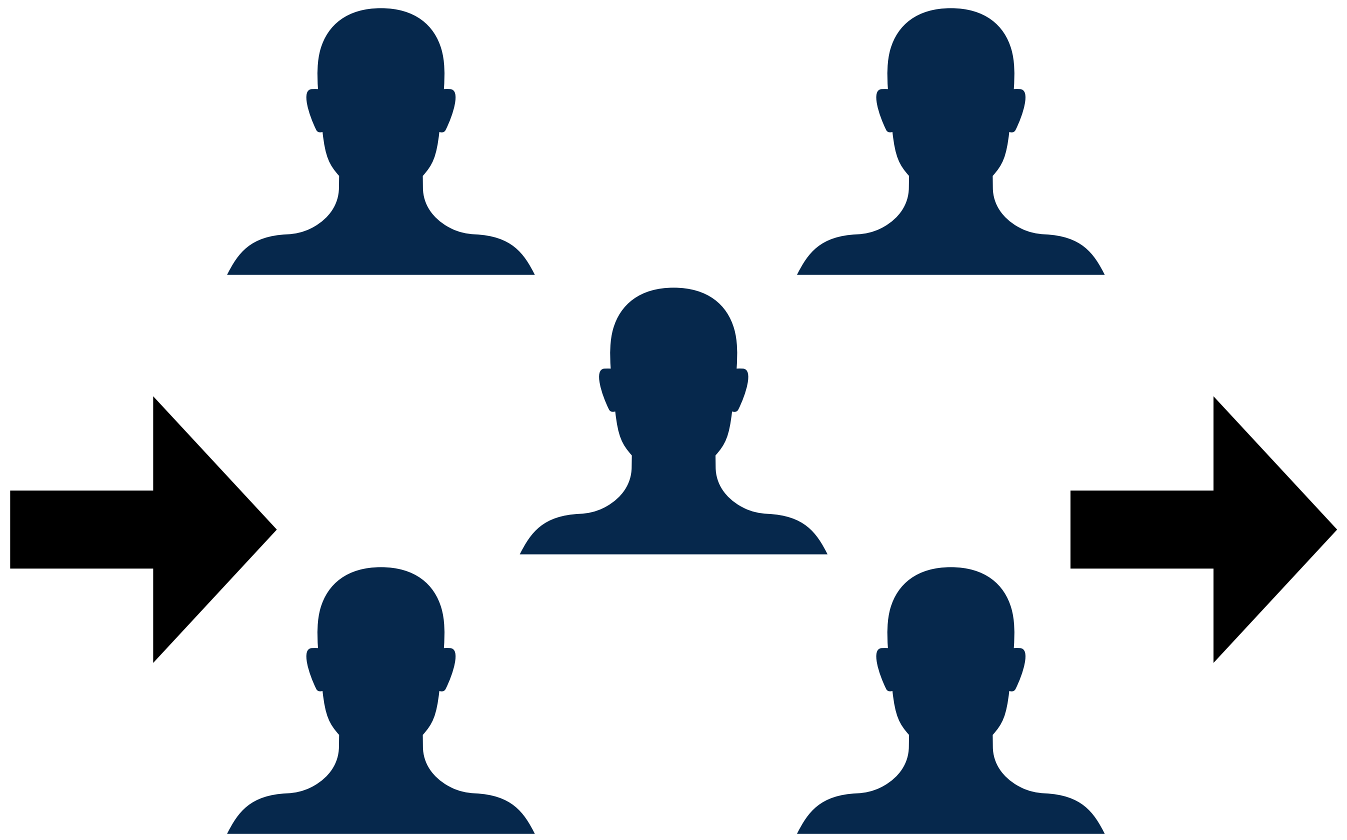
mug

large_marker

Labeling a Dataset



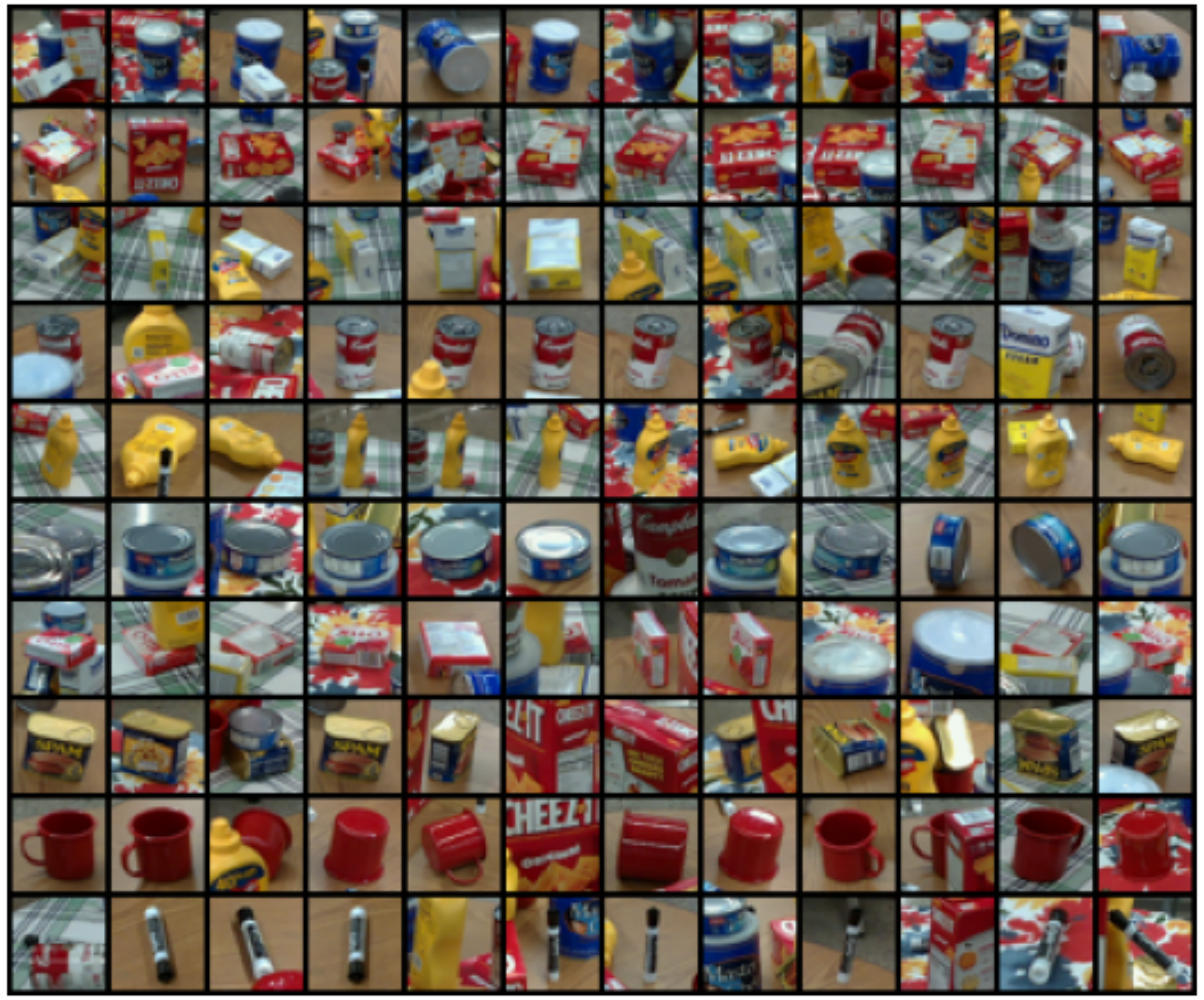
Chen et al., “ProgressLabeller: Visual Data Stream Annotation for Training Object-Centric 3D Perception”, IROS, 2022.



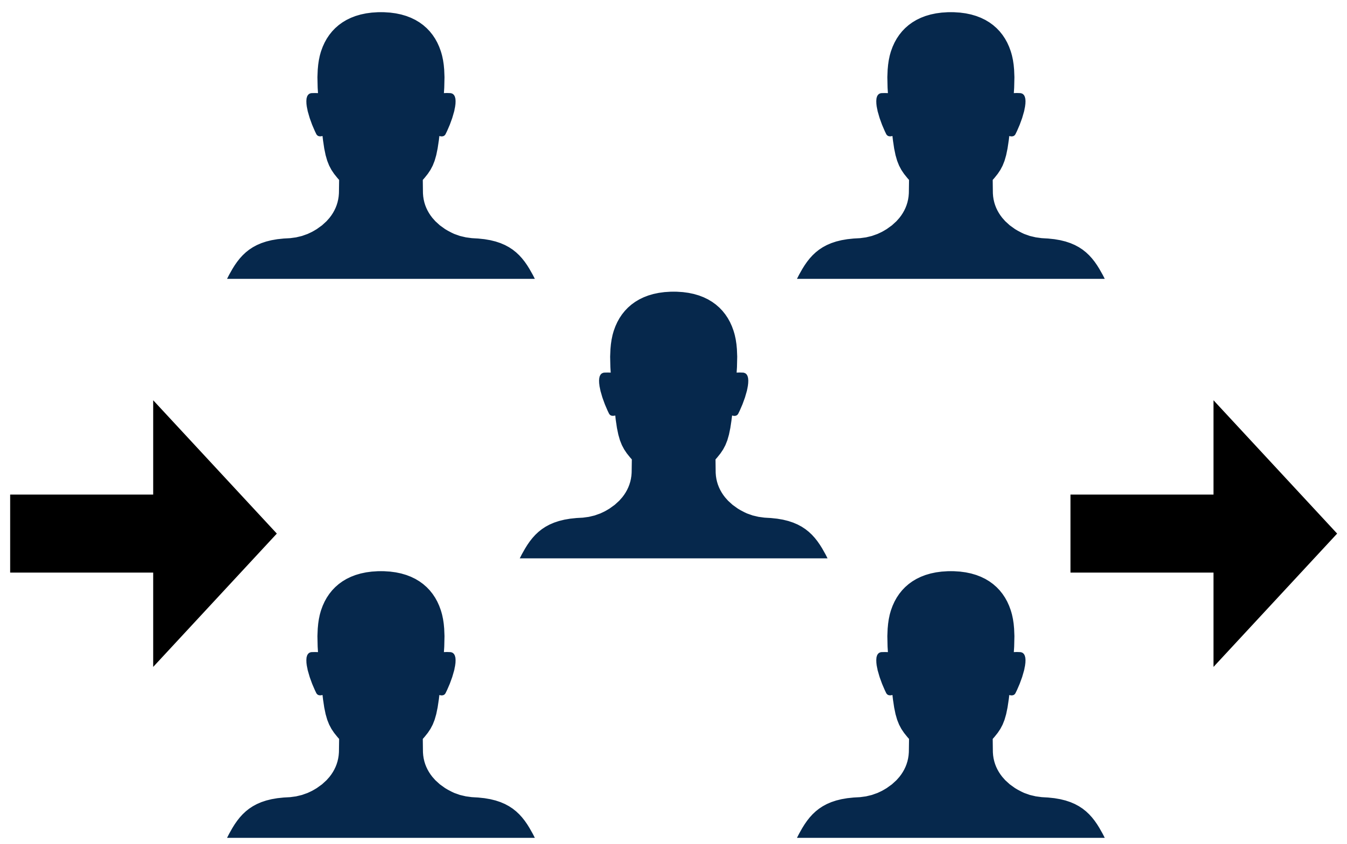
master_chef_can
cracker_box
sugar_box
tomato_soup_can
mustard_bottle
tuna_fish_can
gelatin_box
potted_meat_can
mug
large_marker

Labels are expensive!

Labeling a Dataset



Chen et al., “ProgressLabeller: Visual Data Stream Annotation for Training Object-Centric 3D Perception”, IROS, 2022.



Human Annotators

master_chef_can

cracker_box

sugar_box

tomato_soup_can

mustard_bottle

tuna_fish_can

gelatin_box

potted_meat_can

mug

large_marker

Labels are expensive!

ProgressLabeller—A Tool to Annotate 3D Objects

ProgressLabeller: Visual Data Stream Annotation for Training Object-Centric 3D Perception

Xiaotong Chen Huijie Zhang Zeren Yu Stanley Lewis Odest Chadwicke Jenkins

Abstract— Visual perception tasks often require vast amounts of labelled data, including 3D poses and image space segmentation masks. The process of creating such training data sets can prove difficult or time-intensive to scale up to efficacy for general use. Consider the task of pose estimation for rigid objects. Deep neural network based approaches have shown good performance when trained on large, public datasets. However, adapting these networks for other novel objects, or fine-tuning existing models for different environments, requires significant time investment to generate newly labelled instances. Towards this end, we propose ProgressLabeller as a method for more efficiently generating large amounts of 6D pose training data from color images sequences for custom scenes in a scalable manner. ProgressLabeller is intended to also support transparent or translucent objects, for which the previous methods based on depth dense reconstruction will fail. We demonstrate the effectiveness of ProgressLabeller by rapidly create a dataset of over 1M samples with which we fine-tune a state-of-the-art pose estimation network in order to markedly improve the downstream robotic grasp success rates. Progresslabeller is open-source at https://github.com/huijieZH/ProgressLabeller

I. Introduction

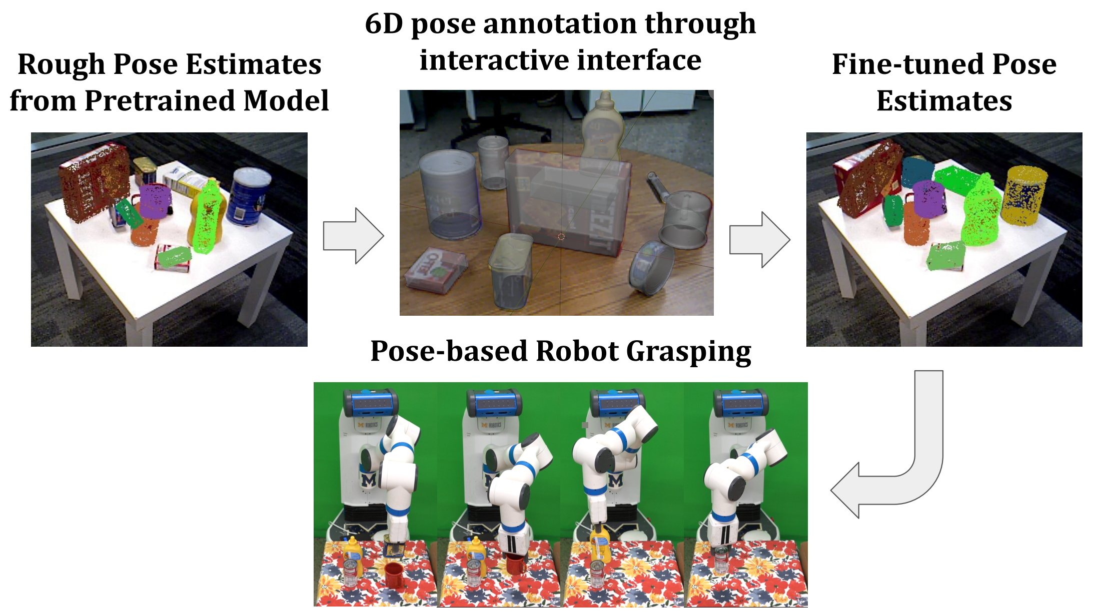
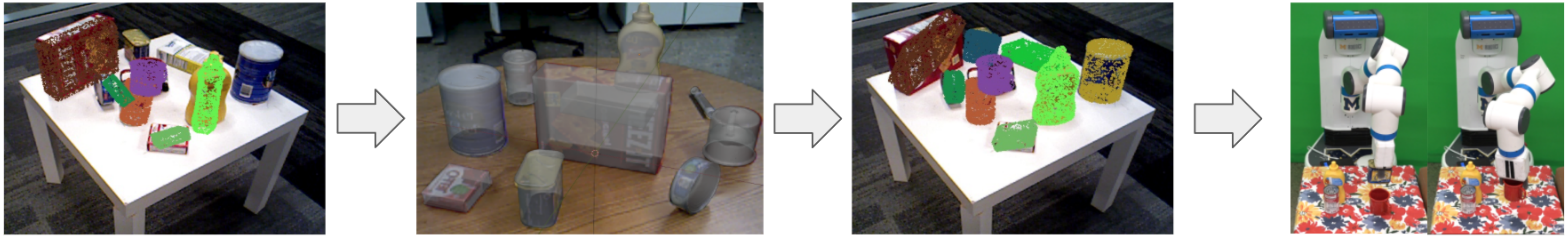


Fig. 1: The ProgressLabeller offers an interactive GUI for aligning all kinds of objects in the 3D scene to generate large-scale datasets with ground truth pose labels. The left image shows the rough 6D pose estimates from one state-of-the-art RGB-D deep models trained on public YCB dataset, and the right images shows fine-tuned pose estimates from the same model after retraining using generated data from ProgressLabeller. The pose estimates are then used for robotic grasping experiments.

Reduces the time needed to generate labels for object classification, pose, segmentation

ProgressLabeller—A Tool to Annotate 3D Objects

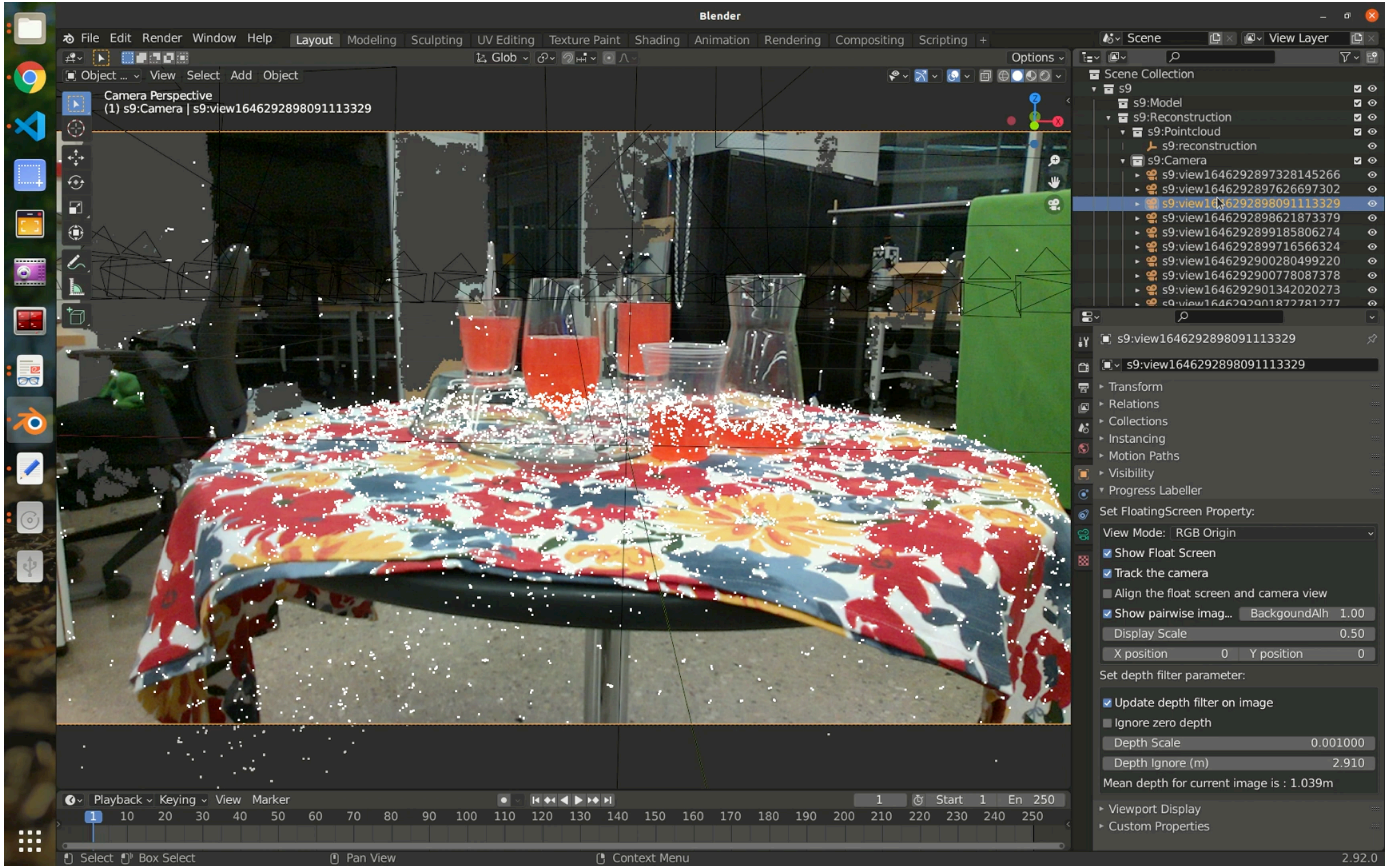


Human Annotator

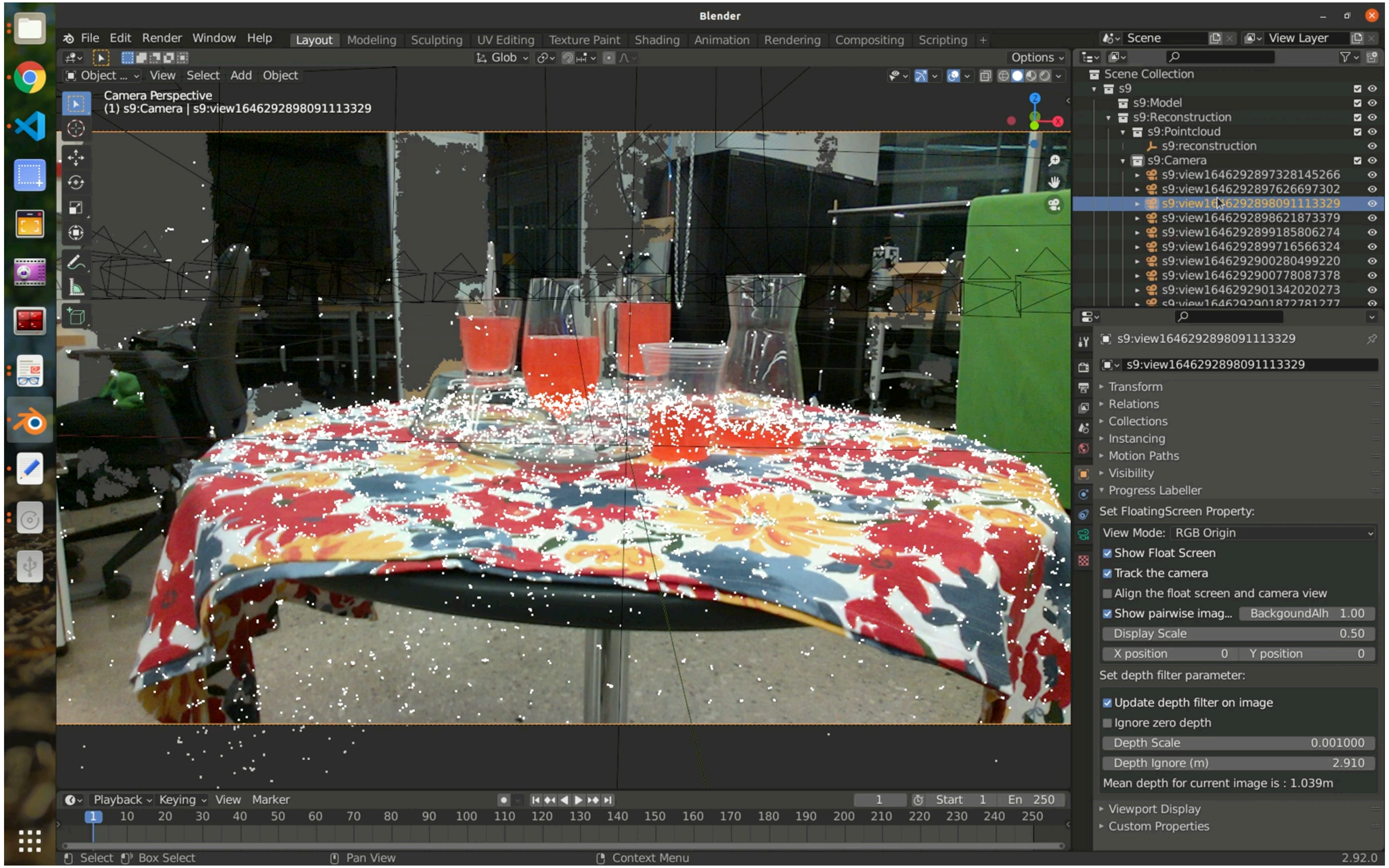
Idea:

1. Record video of scene
2. Human labels object pose in selected frames
3. Pose labels propagate to (large number of) remaining frames

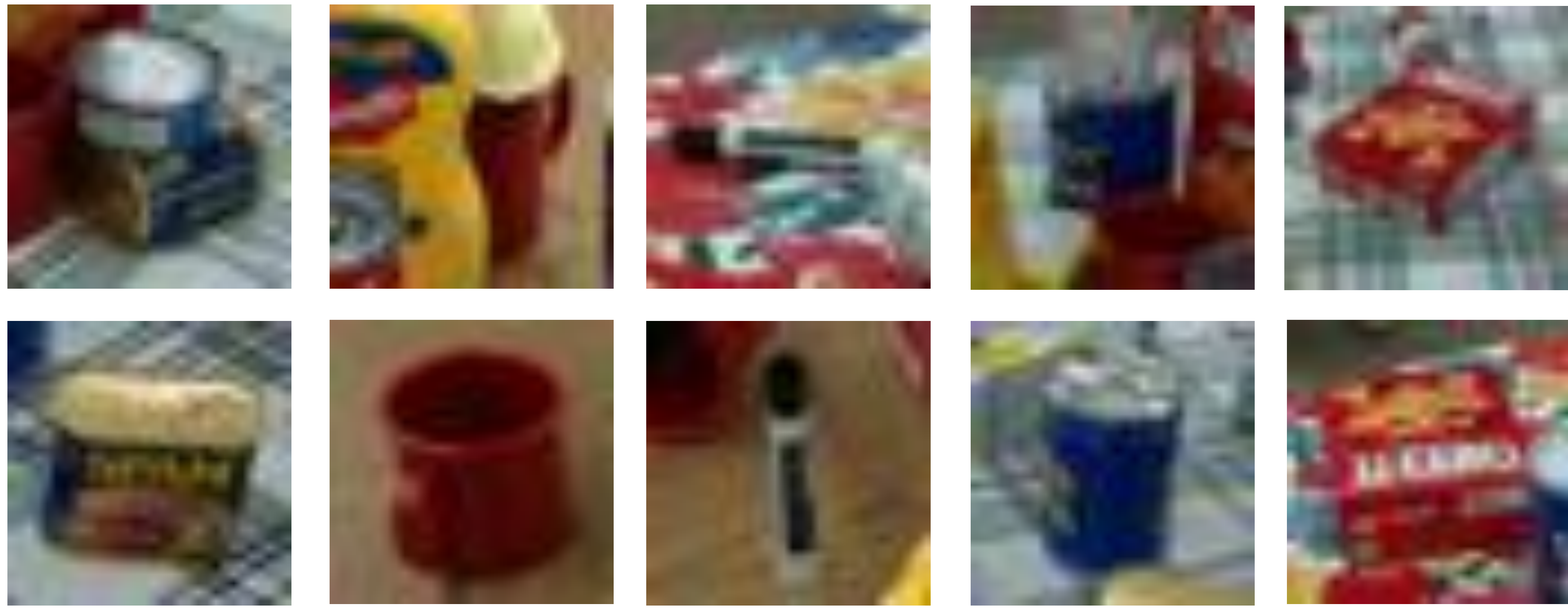
ProgressLabeller—A Tool to Annotate 3D Objects



ProgressLabeller—A Tool to Annotate 3D Objects



DeepRob



Discussion 2
Introduction to the PROPS Dataset
University of Michigan and University of Minnesota