

Branch: master ▾

[Find file](#) [Copy path](#)

CURE-OR / README.md

 **dcantemel** Update README.md

27357ca on Aug 3

2 contributors  

[Raw](#) [Blame](#) [History](#)



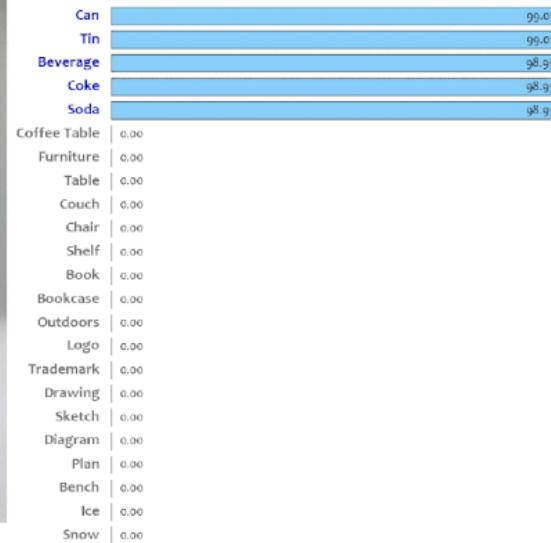
332 lines (292 sloc) 11.3 KB

CURE-OR

OLIVES Lab, Georgia Institute of Technology



Challenge None



The goal of this project is to analyze the robustness of off-the-shelf recognition applications under multifarious challenging conditions, investigate the relationship between the recognition performance and image quality, and estimate the performance based on hand-crafted features as well as data-driven features. To achieve this goal, we introduced a large-scale, controlled, and multi-platform object recognition dataset CURE-OR, which stands for Challenging Unreal and Real Environments for Object Recognition. This repository summarizes the characteristics of our dataset and provides codes to reproduce analysis results in our papers. For more information about CURE-OR, please refer to our papers.

Papers

If you use CURE-OR dataset and/or these codes, please cite:

[CURE-OR: Challenging Unreal and Real Environments for Object Recognition](#)

```
@inproceedings{Temel2018_ICMLA,  
author      = {D. Temel and J. Lee and G. AlRegib},  
booktitle   = {2018 17th IEEE International Conference on Machine Learning and Applications (ICMLA)},  
title       = {CURE-OR: Challenging unreal and real environments for object recognition},  
year        = {2018},}
```

[Object Recognition Under Multifarious Conditions: A Reliability Analysis and A Feature Similarity-Based Performance Estimation](#)

```
@INPROCEEDINGS{Temel2019_ICIP,  
author      = {D. Temel and J. Lee and G. AlRegib},  
booktitle   = {IEEE International Conference on Image Processing (ICIP)},  
title       = {Object Recognition Under Multifarious Conditions: A Reliability Analysis and A Feature Similarity-Based Performance Estimation},  
year        = {2019},}
```

Download Dataset

In CURE-OR dataset, there are 1,000,000 images of 100 objects with varying size, color, and texture, captured with multiple devices in different setups. The majority of images in the CURE-OR dataset were acquired with smartphones and tested with off-the-shelf applications to benchmark the recognition performance of devices and applications that are used in our daily lives. In order to receive the download link, please fill out this [form](#) to submit your information and agree to the conditions to use. These information will be kept confidential and will not be released to anyone outside the OLIVES administration team.

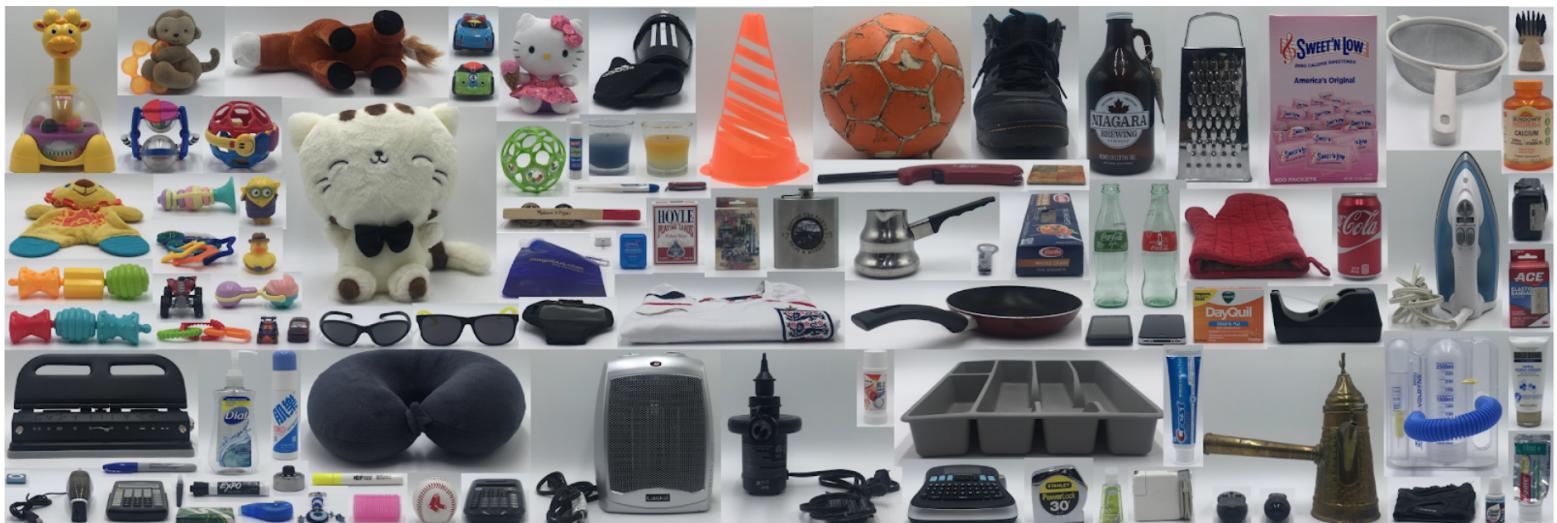
Dataset Characteristics

Object classes (number of objects/class)	Images per object	Controlled condition (level)	Backgrounds	Acquisition devices	Object orientations
Toy (23) Personal (10) Office (14) Household (27) Sports/Entertainment (10) Health (16)	10,000	Background (5) Object orientation (5) Devices (5) Challenging conditions (78)	White 2D (1) Textured 2D (2) Real 3D (2)	DSLR: Nikon D80 Webcam: Logitech C920 Smartphones: iPhone 6s, HTC One, LG Leon	Front (0°) Left side (90°) Back (180°) Right side (270°) Top

Challenging Conditions

	Level 5	Level 4	Level 3	Level 2	Level 1	
Underexposure						
Overexposure						
Blur						
Contrast						
Dirty Lens 1						
Dirty Lens 2						
Salt & Pepper						
Footwear	91.2 Dark	90.5 Indoor	97.2 (None)	97.1 Footwear	98.7 Footwear	98.3 Footwear
Beverage	62.2 (None)	0.0 Outdoors	72.1 (None)	94.9 Footwear	93.7 Indoor	91.7 Indoor
Dawn	78.1 Abstract	86.2 Abstract	86.3 Dawn	78.7 Blur	22.8 Blur	66.7 Blurry
Blur	75.3 Blur	63.3 Blur	27.2 Blur	92.8 Close	24.6 Close	85.7 Blurry
Running Shoe	93.2 Blur	25.5 Blur	92.8 Blur	96.7 Footwear	94.2 Footwear	97.4 Footwear
Asphalt	81.2 Outdoor	88.2 Outdoor	76.1 Outdoor	52.1 Outdoors	96.7 Outdoor	50.6 Head
Pavement	67.3 Outdoor	90.6 Outdoor	57.5 Ground	99.5 Ground	68.9 Footwear	77.2 Footwear
Clothing	51.2 (None)	18.6 Fabric	52.3 (None)	0.0 Clothing	0.0 Laying	98.8 Art
People	60.6 (None)	0.0 People	77.6 Outdoor	85.2 Outdoor	97.1 Ground	97.1 Ground

Objects



Backgrounds

5 Backgrounds: White, 2D Living room, 2D Kitchen, 3D Living room, 3D Office



Devices

5 Devices: iPhone 6s, HTC One X, LG Leon, Logitech C920 HD Pro Webcam, Nikon D80



iPhone 6s

HTC One X

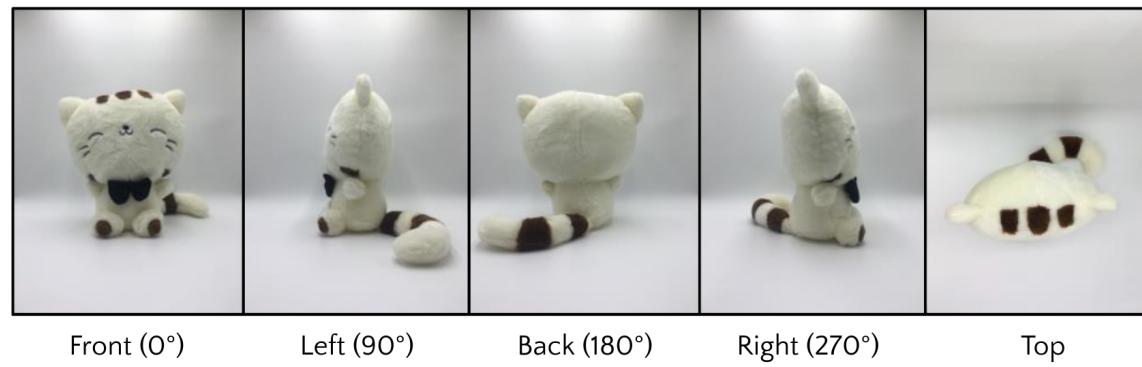
LG Leon

Logitech C920

Nikon D80

Orientations

5 Object orientations: Front, Left, Back, Right, Top



Front (0°)

Left (90°)

Back (180°)

Right (270°)

Top

File Name Format

"backgroundID_deviceID_objectOrientationID_objectID_challengeType_challengeLevel.jpg"

backgroundID:

1: White 2: Texture 1 - living room 3: Texture 2 - kitchen 4: 3D 1 - living room 5: 3D 2 - office

deviceID:

1: iPhone 6s 2: HTC One X 3: LG Leon 4: Logitech C920 HD Pro Webcam 5: Nikon D80

objectOrientationID:

1: Front (0 °) 2: Left side (90 °) 3: Back (180 °) 4: Right side (270 °) 5: Top

objectID:

Object category	Toy	Personal belongings	Office supplies
Object name (ID)	Toy car - orange (020) Toy car - red (021) Baby toy - jingle (037) Baby toy - trumpet (038) Hello Kitty doll (039) Toy - Playskool (040) Jingle stick (041) Toy car (042) Stuffed animal (062) Minion action figure (063) Stuffed animal - horse (076) Rubber duck (078) Toy car - Green (083) Toy car - Blue (084) Monkey (085) Plastic ball - Green (086) Plastic ball - Red Blue (087) Lion (088) Teething toy - Stars Animals (089) Teething toy - Circles Square (090) Toy - Red Blue (091) Toy - Yellow Green (092) Toy (093)	Neck pillow (009) iPhone 4S (011) LG Cell phone (012) iPod Shuffle (013) Sunglasses - Black (024) Sunglasses - Yellow (025) Mac charger (053) Megabus water bottle pack (064) Shoes (069) Canon camera (099)	Square card reader (026) Calculator (034) Hole puncher (046) Glue stick (047) Liquid white out (048) Tape white out (049) Marker - Expo black (050) Marker - Sharpie blue (051) Highlighter (052) Logitech Presenter remote (059) Kensington Presenter remote (060) DYMO label maker (061) Calculator (066) Tape dispenser (095)

Object category	Household	Sports / entertainment	Health / personal care
Object name	Coca cola bottle - Red (001) Coca cola bottle - Green (002) Lasko Heater (006) Rival Clothing	Baseball (005) Soccer jersey (008) Electric air	Medicine - Spray (003) Medicine (004) Hair

(ID)	iron (007) Flask (015) Candle - Yellow (016) Candle - Blue (017) Lock (022) Fish keychain (027) Multipurpose pocket knives (028) Bottle opener (030) Chewing gum (033) Tile (043) Silver coffee pot (045) Cleaner (055) Stanley Tape measure (058) Jar (065) Cutlery tray (067) Strainer (070) Pan (071) Cheese grater (072) Barilla Spaghetti (073) BIC Lighter (074) Oven mitt (075) Gold coffee pot (082) Coca cola can (097) Sweet N Low sweetner (100)	pump (010) Adidas Shinguard (014) Gloves (018) Armband (019) Training marker cone (068) Deck of cards - Hoyle (079) Deck of cards - Savannah (080) Soccer ball (081)	brush (023) Toothbrush (029) Toothpaste - Full (031) Toothpaste - Empty (032) Dayquil cold medicine (035) Hand soap bottle - Empty (036) Thermometer (044) Hair roller (054) Floss (056) ACE Elastic bandage (057) Hudson Volumetric exerciser (077) Calcium bottle (094) Hand cream (096) Hand sanitizer (098)
------	--	---	---

challengeType:

01: No challenge 02: Resize 03: Underexposure 04: Overexposure 05: Gaussian blur 06: Contrast 07: Dirty lens 1 08: Dirty lens 2 09: Salt & pepper noise 10: Grayscale 11: Grayscale resize 12: Grayscale underexposure 13: Grayscale overexposure 14: Grayscale gaussian blur 15: Grayscale contrast 16: Grayscale dirty lens 1 17: Grayscale dirty lens 2 18: Grayscale salt & pepper noise

challengeLevel:

A number between [0, 5], where 0 indicates no challenge, 1 the least severe and 5 the most severe challenge. Challenge type 1 (no challenge) and 10 (grayscale) has a level of 0 only. Challenge types 2 (resize) and 11 (grayscale resize) has 4 levels (1 through 4). All other challenges have levels 1 to 5.

Challenging Conditions Generation

Python Imaging Library (PIL) version 4.2.1 and scikit-image version 0.13.0 are utilized to generate challenging conditions. Salt and pepper noise is synthesized with scikit-image and all other challenging conditions are simulated with PIL. The minimum and maximum parameter values for each challenge type except dirty lens 2 and grayscale are provided below, and parameter values are linearly spaced between the two for different challenge levels.

- Resize: downsample with bicubic interpolation; the size of a new image is determined by multiplying pixel dimensions of an original image by factors linearly spaced between 1 (exclusive) and 0.5 (inclusive)
- Underexposure: brightness control with factors between 0.4 and 0.08
- Overexposure: brightness control with factors between 1.4 and 6
- Gaussian blur: radius of blur between 8 and 60
- Contrast: increase separation between dark and bright colors on spectrum by factors between 2 and 5
- Dirty lens 1: blends a single dirty lens pattern into an image with weights values between 0.2 and 0.65
- Dirty lens 2: overlays a distinct dirt pattern onto an image for each challenge level
- Salt & pepper noise: replaces random pixels of an image with either one or zero, with amount between 0.2 and 0.9
- Grayscale: convert an image into monochrome

Paper Data

Download the analysis data from [here](#) and unzip it under the same directory as the codes. The folder structure is as following:

```
└── AWS/                                # Recognition results from AWS Rekognition API
    └── 01_no_challenge/                 # Organized in folders by challenge types of CURE-OR
        └── ...
    └── ...
└── Azure/                               # Recognition results from Microsoft Azure Computer Vision API
    └── 01_no_challenge/                 # Organized in folders by challenge types of CURE-OR
        └── ...
    └── ...
└── IQA/                                 # Matlab codes for image quality assessments
    └── IQA_codes
    └── Result                           # Image quality results organized in folders by objects
    └── ...
└── CBIR/                                # Content-based image retrieval
    └── Features                         # Extracted features
    └── Performance                      # Performance of recognition applications preprocessed for analysis
    └── Distance                          # Distance between features of "best" images and the rest: averaged across
        objects
```

CBIR codes were referenced from [this repo](#).

To see the analysis results, simply run:

```
python analysis.py
```

The results will be stored under `Results/`.