3D objects classification in points cloud based on deep network trained with synthetic data set

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Project goal was to classify 3D objects represented as points cloud. The points cloud is extracted from a scanned scene using segmentation preprocessing.

The solution approach included:

The Data Set

1. Creating a synthetic data set (2000 images). For each type of 3D object (in the project scope: boxes and balls) scanned data was created in different sizes, orientations, colors, textures, backgrounds, lightning.

2. Data set using images from the network (620 images). The images were tagged according to specific characters:

   - Texture – whether the object has a texture.

   - Background – if background has texture or single color.

   - Multi– a single object or multi-objects.

   - Perfect – full and perfect edges/ in cube whether all edges are straight lines. For the balls, whether the ball is round.

   - Visible – is the all object is shown in the image.

   - Standout – is the object salient. Differs from the background.

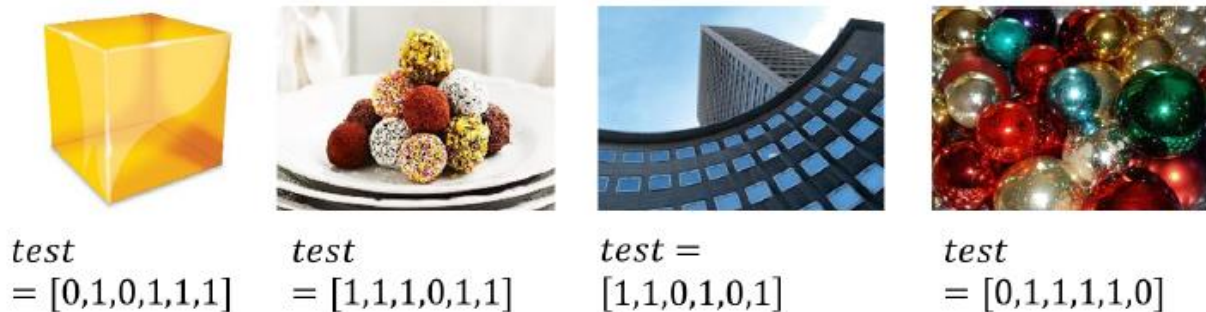The tagging vector: $test = [texture, background, multi, perfect, visible, standout]$

$test = [0,1,0,1,1,1]$ $test = [1,1,1,0,1,1]$ $test = [1,1,0,1,0,1]$ $test = [0,1,1,1,1,0]$
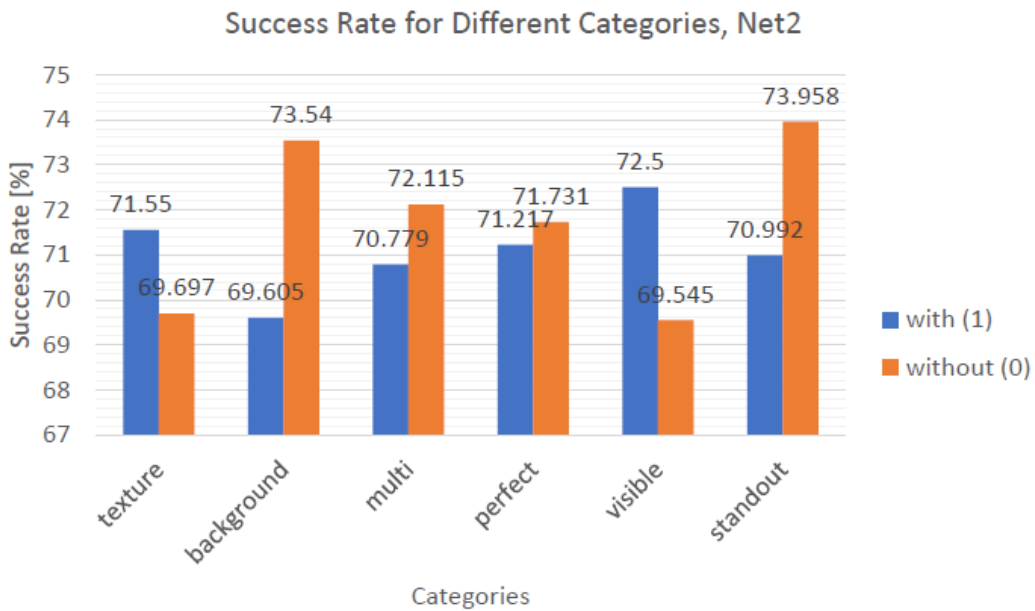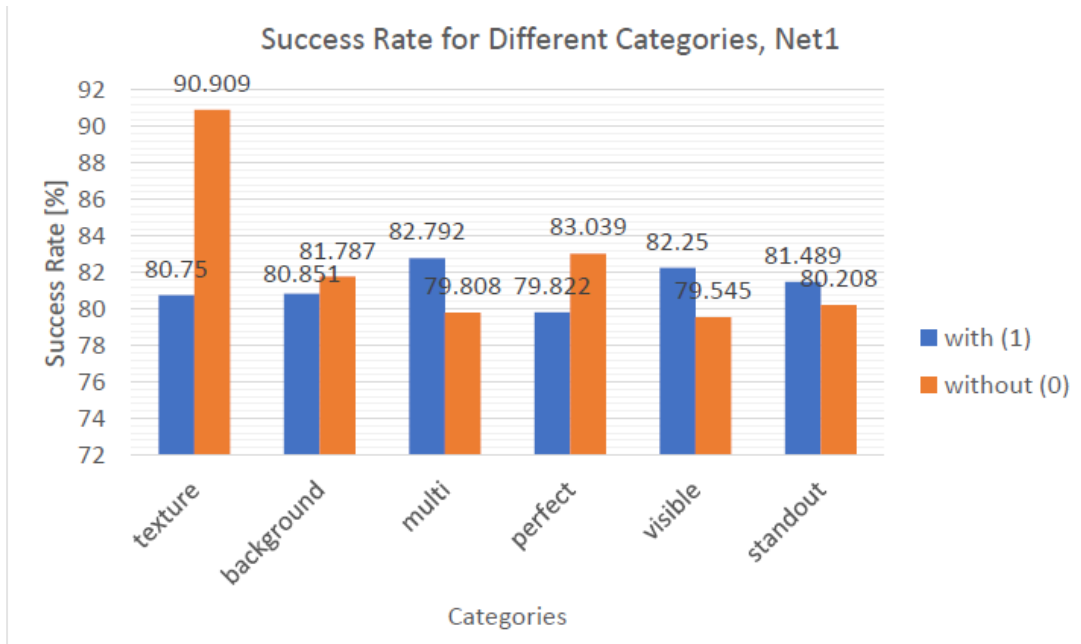
Figure 1: examples for tagging

Deep Network

Selecting deep network architecture. AlexNet was selected.

The trained and tested data sets were 80% and 20% from the whole data set respectively.

The network was trained with two different data sets. Thus, Network 1 and Network 2 were created.
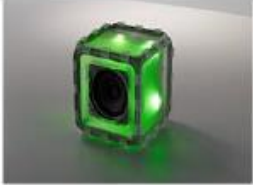
Results

Success Rate for Different Categories, Net1

Success Rate for Different Categories, Net2

Figure 2: results examples