Multi-Viewpoint Object Recognition

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***Abstract*— Object recognition capability is a essential condition for giving autonomy to mobiles robots in human made environment. However, achieving this goal by means of visually representing objects is a hard task ?? and using all possible sources of information is a must. Here we present a procedure to incorporate the notion of continuity and overcome ambiguous points of view. By observing objects from different perspectives binded with a Markovian modeling of the stochastic processes of recognizing each of the objects viewpoint, the algorithm copes with a sparse database, blurred images from motion and object spatial symmetry, to recognize and estimate objects 6-dof pose. A multi-modal Kalman based tracking was also implemented in order to recognize multiple objects simultaneously. The approach was tested in a mobile platform and the comparison between the single viewed and the proposed recognition gave promising results.**

I. INTRODUCTION

The vast majority of the literature focus on single image object visual recognition for helping robots in tasks such as semantic navigation **??**, pose estimation for grasping **??** and environmental search **??**. Typically, a set of features is extracted from a segmented object candidate and, subsequently, compared to a database of priori known objects. Extensive work have been done in order to increase efficiency in each one of the sub-processing steps. Among them : segmentations methods using range cameras, features that describe color and texture **??**, geometry **??**, contours **??**, besides classifiers and matching techniques. Alternatively, a deep neural architecture **??** can perform a direct object visual classification after a delicate training phase. However, the classic recognition pipeline seems to be more natural and simple to be implemented with a straight-forward training, still having reasonable results.

Nevertheless, ambiguous viewpoints easily trick visual descriptors reducing its recognition capability. Observing objects sequentially from distinctive points of view seems to be a natural way to deal with the problem. A solution inspired by human behavior for learning new unseen objects has been proposed by **??**, using key-frames and the rate of matching features with past frames, to overcome ambiguity in face recognition task. More work have been done to model objects different viewpoints perspectives summarized by Roy and al. **??**.

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II. PROPOSED METHOD

We present a viewpoint multiple object recognition for indoor environments.

A. Segmentation

First, confirm that you have the correct template for your paper size. This template has been tailored for output on the US-letter paper size. It may be used for A4 paper size if the paper size setting is suitably modified.

B. Feature

C. Aspect-Graph

D. Multi-object Tracking

E. Viewpoint Recognition

III. EXPERIMENTS

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$$\alpha + \beta = \chi \tag{1}$$

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- The subscript for the permeability of vacuum ?0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter o.
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TABLE I
AN EXAMPLE OF A TABLE

One	Two
Three	Four

We suggest that you use a text box to insert a graphic (which is ideally a 300 dpi TIFF or EPS file, with all fonts embedded) because, in an document, this method is somewhat more stable than directly inserting a picture.

Fig. 1. Inductance of oscillation winding on amorphous magnetic core versus DC bias magnetic field

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity Magnetization, or Magnetization, M, not just M. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write Magnetization (A/m) or Magnetization A[m(1)], not just A/m. Do not label axes with a ratio of quantities and units. For example, write Temperature (K), not Temperature/K.

V. CONCLUSIONS

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

APPENDIX

Appendixes should appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word acknowledgment in America is without an e after the g. Avoid the stilted expression, One of us (R. B. G.) thanks . . . Instead, try R. B. G. thanks. Put sponsor acknowledgments in the unnumbered footnote on the first page.

References are important to the reader; therefore, each citation must be complete and correct. If at all possible, references should be commonly available publications.

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