

SEMINAR TOPICS

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TOPIC

Semantically-Guided Image Compression for Enhanced Perceptual Quality at Extremely Low Bitrates

ABSTRACT:

Image compression methods based on machine learning have achieved high rate-distortion performance. However, the reconstructions they produce suffer from blurring at extremely low bitrates (below 0.1 bpp), resulting in low perceptual quality.

Although some methods attempt to reconstruct sharp images using Generative Adversarial Networks (GANs), reconstructing natural textures at low bitrates remains challenging. In this paper, we propose a novel image compression method that explicitly utilizes semantic information.

Specifically, we send a semantic label map to the decoder, which takes it as input. This semantic information enables the decoder to reconstruct appropriate textures consistent with the corresponding semantic classes.

Although semantic label maps can be compressed into relatively small data sizes using common methods (e.g., PNG), the data size is not negligible in an extremely low-rate setting.

To address this problem, we propose simple yet effective label map compression strategies, including an autoregressive label map compressor.

Our strategies significantly reduce the data size of the label map while maintaining the critical semantic information that allows the decoder to reconstruct realistic and suitable textures. By utilizing this data-efficient semantic information, our method can reconstruct realistic images even at an extremely low bitrate.

As a result, the proposed method outperformed existing models, including a GAN-based model designed for low-rate settings and a state-of-the-art semantically guided method, in both quantitative evaluation and user studies. Furthermore, we analyzed the effect of semantic information by switching the input label map, confirming that the model synthesized textures appropriate to the given semantic labels

TOPIC

Turning Trash into Treasure: Developing an Intelligent Bin for Plastic Bottle Recycling

ABSTRACT:

Plastic pollution has emerged as a major global concern due to its enduring nature and limited recycling options.

In response to this critical challenge, this paper presents a novel approach utilizing a Detection-Based Reward System (DBRS) alongside an innovative business model to promote effective plastic waste management, reduce plastic waste accumulation in the nature, and uphold environmental cleanliness.

Leveraging the YOLOv5 algorithm for its exceptional accuracy, speed, and open-source availability, plastic bottle detection becomes a pivotal aspect of this system. Users seamlessly enroll in the system, triggering an automated detection process that computes reward points corresponding to their deposited plastic bottles.

These reward points are meticulously stored within a centralized database. Beyond its operational facets, this comprehensive system encompasses a robust business model, strategically poised to capture widespread engagement with waste disposal practices, thereby contributing to the realization of Sustainable Development Goals (SDGs) geared towards fostering a healthier environment.

Notably, the DBRS attains cutting-edge performance in plastic bottle detection, boasting an impressive mean Average Precision (mAP) of 0.973, underscoring its efficacy in tackling plastic pollution.

TOPIC

Streaming Processing for ADL Monitoring in Smart Home Environments

ABSTRACT:

Monitoring and detection of Activities of Daily Living (ADL) is a frequent practice to determine the independence of elderly/disabled people in their homes instrumented with a set of sensors, which conform smart home environments.

In these scenarios there are two main problems that need to be addressed: the representation of the ADL and the real time processing of the data gathered by the sensor network. Regarding the first aspect, a reliable representation and modeling of ADL to support their automatic representation must consider factors such as human location, presence of physical objects, and time.

Concerning the second aspect, the huge volume of data produced by the sensor network at different velocities and with varied formats must be processed as they are generated in order to be able to provide timely responses.

In this sense, we extend a previously proposed framework aimed at assessing the level of independence of an elder person living in a smart home by integrating: (i) the HAMSTERS-XL notation to represent ADL and to instantiate independence evaluation models; and (ii) capabilities for batch and streaming processing, based on Big Data engines.

We illustrate the suitability and functionality of the extended framework with a use case consisting of a virtual smart home environment and an inhabitant performing five ADL represented with HAMSTERS-XL and the AGGIR grid model.

With this experience, we highlight the benefits of task models to represent ADL combined with the use of Big Data tools to process data. We also identify the limitations of the current version of the framework, in terms of the number of people that can be monitored in the same smart home and the deployment in real scenarios, which will be approached in future research.

TOPIC

A Blockchain-Based Hybrid Architecture for Auditable Consent Management

ABSTRACT:

Consent management has become an important issue with the increased usage of the Internet and also smart devices that collect personal data. Each country enacts its regulations and laws for consent management.

These laws ensure that personal data is not collected without the individual's consent and cannot be processed with a purpose other than the stated purpose. The General Data Protection Regulation (GDPR) has strict rules regarding collecting and processing personal data. This paper proposes a new approach for auditable hybrid consent management systems using blockchain technology and a purpose tree. The suggested approach includes (1) the implementation of a GDPR-compliant consent management system using block chain and purpose tree; (2) the implementation of an audit mechanism that detects consent violations and corrects consents; and (3) the use of both on-chain and off-chain technologies.

The audit mechanism proposed in this paper detects possible violations by performing inspections on every transaction in the system. Besides, it immediately informs the data subject and the competent authorities regarding the relevant violations.

As part of this study, a prototype of the architecture is developed as a proof of concept to evaluate the performance of critical components. The obtained experimental results show that the proposed hybrid architecture that use purpose tree effectively supports consent sharing between the parties.