



A survey on hierarchical classification using Image data

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Abstract

With the rapid growth of social media, the quantity of images being uploaded to the internet is exploding. Very huge quantities of pictures are shared through multi-platform services/social media such as Snapchats, Instagram, Facebook & what's App. Recent studies estimate that over 1.8 billion photos are being uploaded every day. To handle this large amount of data, various classification techniques are used. In this paper, to report on that various classification techniques used for Large-scale Image data. The key benefits of using this classification to boost in time efficiency without compromising the result performance.

Keywords: image classification, big image data, distributed system

1. Introduction

Hierarchical Classification on Big Image Data receives more attention in recent year. Due to many application such as Active ranking^[20], Feature extraction^[5, 21], Data Anonymization^[22] and Parallel processing^[23]. Recently, Image processing has increase wide application in various areas such as engineering, Industrial manufacturing, Military & health etc. on the other hand, huge data amount comes along and hence triggers server constraints on data storage and processing efficiency, which calls for urgent solution to retrieve such limitation.

With the spread of social media in recent year, an oversized quantity of image information has been accumulating. Once process this huge information resource has been limited to single computer, computational power and storage ability quickly become bottlenecks. Alternately, processing task can usually be performed on a distributed system by dividing the task into many subtask. The ability to parallelize tasks permits for scalable, efficient execution of resource intensive applications.

To improve the time efficiency of those entire algorithms can move nodes in simultaneously. Couple of common structure is obtained for such image processing methods that probably increased powerful execution for their parallelism.

This survey paper includes the various Hierarchical classification framework for Big Image data. Each Framework has its own structure for classification and also compare with the previous methods^[5-10] and shows the result performance of that framework.

2. Review of Literature

With the rapid usage of increase in online Image storage and social media on sites like Facebook, Flikar and Picasa, a lot of image knowledge is obtainable than ever before & is growing every day. So the large-scale Image data is generated every day. Then the Image processing is needed on such a large-scale Image data. The explosion of obtainable Images on social media has motivated for image process analysis &

application development, which will advantage of very large image information.

Richang Hong *et al.*^[1] investigate how to establish the relationship between data which is based on the semantic concepts & the large-scale real world click data from image commercial engine. It also handle the click data problem which suffer from the noise such as typos, the same concept with different queries. To establish the concept relationship, the each part of concept relationship classified into five special relationship. After that to improve the representative power by applying them to augment image tag.

Kaiqi Huang *et al.*^[2] proposed the image classification method. In Image classification, the feature encoding relation between the visual words is most important. In this paper author proposed an efficient classification framework i.e. High-Order topology in visual word in feature space. First, author proposed algorithm i.e Search algorithms, which seek dependence between visual words, which is used to make higher order topology in feature space. Secondly, the local features are encoding to improve the image classification.

Le Dong *et al.*^[3] proposed a new approach i.e Scene-Oriented Hierarchical classification of Blurry and Noisy Image. This approach is based on the three categories: i) Extraction of essential signature captured form global context by using global pathway. ii) Highlight detection based on local feature of the newly form image by using local pathway. iii) Hierarchical classification of extraction feature by using probabilistic techniques. By using scene centered global pathway based approach is appropriate authority occur independent level of the complexity of image. It is powerful at many level of the ease of goal intolerance on blurry and noisy image.

Le Dong and Ebroul Izquierdo *et al.*^[4] proposed a new approach of the system for visual information analysis & classification based on the biologically inspired visual selection model with present a knowledge structure. The system is based on procedure of human brain. It consists of

three parts: i) Biologically inspired visual selection attention. It is based on low level feature extraction from natural image and also contain low level top-down selective attention module for performing decision using human interaction. ii) Knowledge structuring, this unit automatically creates a relevance map from salient image area generated by the previous unit. It mainly consists of distribution mapping unit. This unit consists of two basic modules i.e. structured low-level feature extraction using neural network & topology representation module. iii) Clustering of visual information. In this unit, System classification is performed by simulating high-level visual information perception and clustering using incremental bayesian parameter estimation method.

3. Hierarchical Classification Method

3.1 Visual Semantic Relationship Method

In visual semantic relationship, First define & model the relationship between the concept i.e concept relationship. There are five types of Concept Relationship:-

- a. Complete Similarity (CS) - which is used to determine whether the two concepts have the same meaning.
- b. Type Similarity (TS) -which is used to indicate the relationship between two concepts belong to the same object.
- c. Hypernym Hyponym(HH) - which is used to super-subordination relationship.
- d. Parallel Relationship (PR) - which is used to refer the two concepts share the same super base class.
- e. Unknown Relationship (UR)-There are no relation in the concepts.

To find the characterized relationship between concepts there are eight type of feature i.e Visual word(VW), Spatial Visual Word(SVW), Edit Distance(ED), Earth Movers Distance (EMD), Jensen Kmeans (JK),Cosine Kmeans (CK),Jensen Hash(JH), Cosine Hash(CH), Exemplar Similarity(ES), Normalized Google Distance(NGD).

By using these to extract some concepts relation feature in textual and visual domain to train the concept relationship

model and then relationship of each pair of concept classified into five type of relationship ^[1].

3.2 High-Order Topology Modeling:

Higher-Order Topology of visual word (HTVWs) is an efficient classification framework in the feature space. This framework has two steps as follows:

- a. Relationship searching: for each visual word, it search it's dependence between visual word based on the distance and orientation. Constructing the Higher-order topology or relationship in the feature space using the dependence.
- b. Feature Encoding: for each local feature, the higher-order topology is used to better encode the feature ^[2].

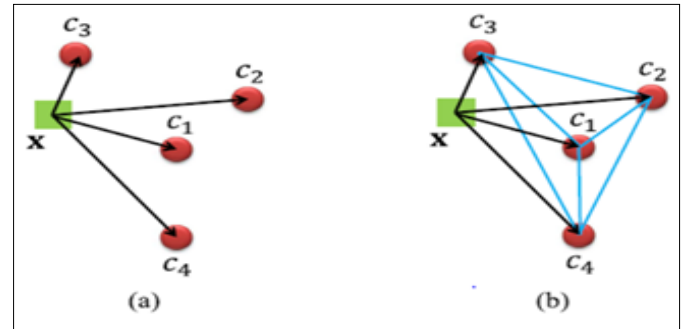


Fig 1: Higher-order relationship of visual words for feature encoding. (a) Traditional feature encoding method. (b) feature encoding with higher-order relationship ^[2].

3.3 Scene-Oriented Hierarchical Classification:

This system consists of two parallel pathway i.e. global pathway & local pathway. The global pathway is for essential capture image and the local pathway for the highlight detection. In the global pathway for essential capture, the layout representation is generated directly from blurry & noisy image and which is used for essential capture. On other hand, in the local pathway for highlight detection, pseudo-restoration precedes a local highlight detection step for accurate detection in the local pathway.

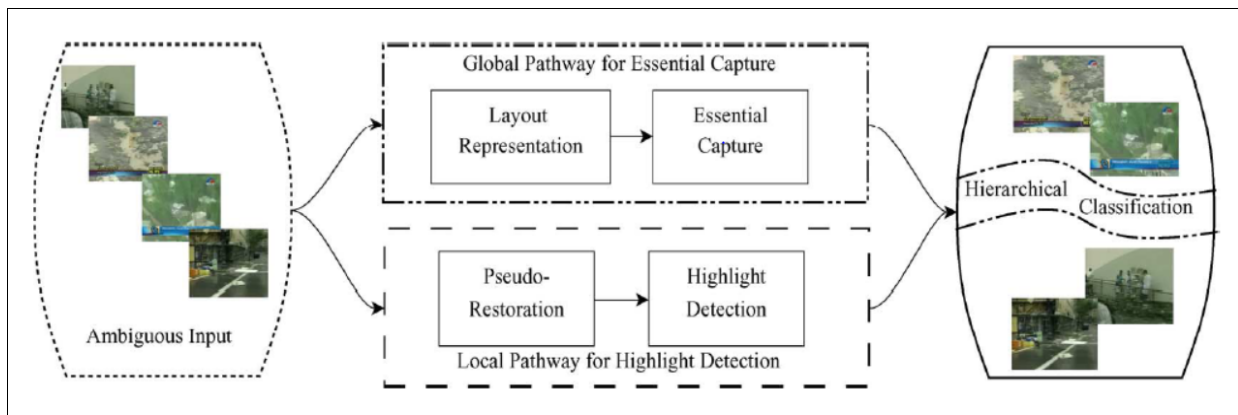


Fig 2: System Framework for scene oriented hierarchical classification ^[3].

In the global pathway, the layout representation from the ambiguous input and then progresses to perform essential capture. By using semantic concepts, form the visual context, which is used to constrain the classification. This path

generates the information that link a particular low & medium level description of the visual information with high level representation. Then it automatically infers global knowledge to feed the final hierarchical classification in parallel the local

pathway starts with corrupted input to the pseudo-restoration, then the local highlight detection is conducted. By using the output of both local and global pathway to generate the final hierarchical classification. In hierarchical classification first Monte Carlo feature clustering is applied to support inference on the potential category [3].

3.4 Biologically Inspired System

By using extracted high level knowledge from dataset

automatically classifies the visual information. The proposed system creates a relevance map for semantic based classification. The biologically inspired visual selective attention model consist of two parts i.e. Bottom-up saliency map and low level top-down selective attention which are integrated. The knowledge structuring model can be derived. Clusters of specific group can be generated by using information from the knowledge structuring model.

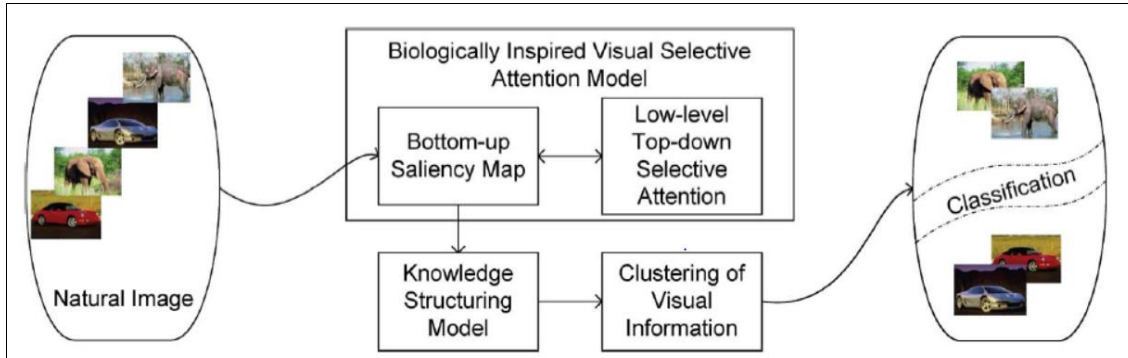


Fig 3: Biologically Inspired System Framework [4].

4. Results & Discussion

Performance observed of different methods such as Visual Semantic Relationship, High-order topology modeling, Scene oriented Hierarchical classification & Biologically Inspired System of the Hierarchical Classification for Big Image Data. The Visual Semantic Relationship framework compare with the state-of-the-art methods in terms of the image retrieval performance, the proposed framework is better as compared to the other method [1].

PCAH [5], which learns hash, functions using Principal Projection.
 SH [6], Which is based on the classical spectral method for finding thru best binary codes.
 AGH [7], which learn appropriate compact codes for automatically discover the neighbor structure.
 ITQ [8] to minimize the quantization error it tries to find the rotation of zero centered data.

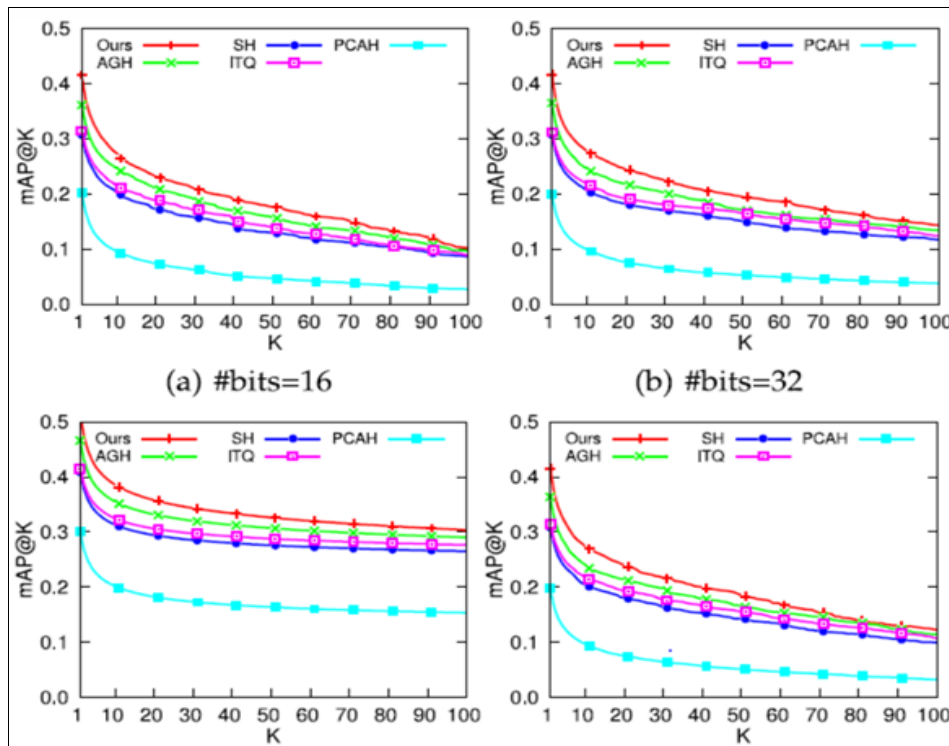


Fig 4: Performance of all comparison algorithms with proposed framework [1].

The High order relationship model is compare with the different feature encoding methods i.e. Hard Quantization (HQ), Soft Quantization (SQ)[9] & Local Constrained Linear

Quantization (LLC)[10]. The Proposed method is better as compare to the other feature encoding methods. Author use the codebook with the same dimensionality for comparison.

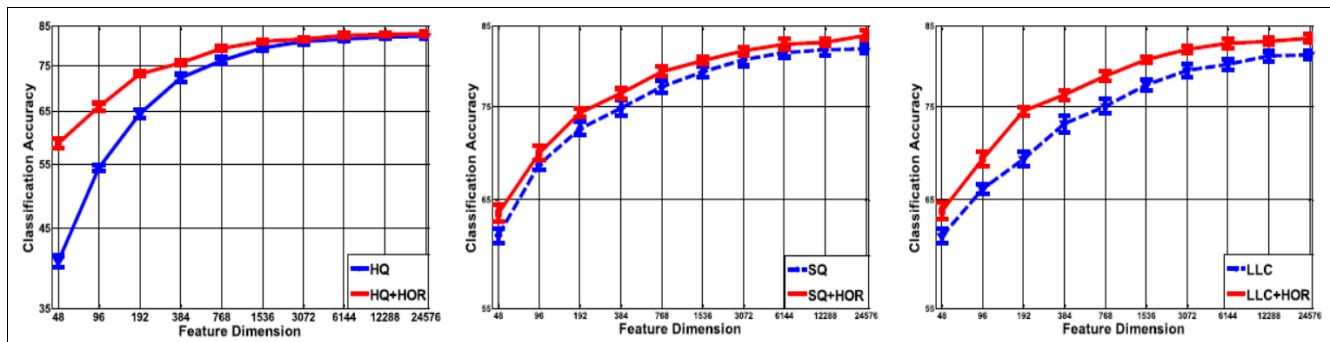


Fig 5: The comparison of feature encoding method with higher order relationship method[2]

Fig.5 shows the classification accuracy of the three encoding method with the higher-order relationship model, so, the proposed model achieves the consistent improvement [2].

The performance of the biologically inspired system approach compare with the two binary image classifier i.e. one based on the ant colony optimization (ACO / COP – K mean) [16] and the other using particle swarm optimization self-organizing feature map (PSO / SOFM) [17]. The table 1 shows the summary of results on same subsets of the image categories.

Table 1: Results of the proposed technique compared with two other Binary classifiers [4].

(%)	ACO/ COP-K-Means		PSO/ SOFM		Proposed technique	
	P	R	P	R	P	R
lion	55	62	48	69	88	85
elephant	71	71	74	65	87	94
tiger	63	58	68	64	85	88
cloud	62	57	69	63	94	92
car	65	56	70	64	88	84
building	65	62	51	74	89	83

5. Conclusions

This paper is a survey of current research on the hierarchical classification of Image. The hierarchical classification receives intensive attention in recent years due to many practical application. There are different classification framework are used like visual semantic relationship, High-Order topology, Scene-Oriented Hierarchical classification, biologically inspired classification etc. These classification method perform with better result.

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