Incorporating Domain Knowledge in Matching Problems via Harmonic Analysis

Amit Kumar
akkumar@iitk.ac.in

Matching two objects in machine learning is a tough task. This can be solved by reducing it to some form of QAP.[2] The **quadratic assignment problem** (**QAP**) is a combinatorial optimization problems. [1] The QAP is very hard to solve. It is a problem of matching two weighted graphs G and G' with adjacency matrices A and A' , to maximize the overlap between them.

Summary

In this paper author gives an algorithm to solve Matching problem by solving QAP problem based on the learning a modified objective function f from a set of prior "training" QAP instances. At test time, only a sample set (training set) X is known, and a prediction function $f : X \rightarrow Y$ maps it to a predicted label from the label space.[3] There is one property of this function, the inverse map of f can be expressed, which makes this f learnable.[2] This function is expressed as the graph correlation between the two graphs G and G'.[2] We can use features such as Euclidean distance between interested points, Shape context features etc for establishing relationship between the vertices of G.[2] They transformed the learning problem using ideas from the theory of non-commutative Fourier analysis on the symmetric group. [2]

Contributions

The contribution of this paper is the parameter learning framework for a class of combinatorial problems where the solution is a candidate in the symmetric group Sn . We show how the representation theory of S_n makes the procedure computationally tractable, and how Branch and Bound schemes can be modified to learn information relevant for problem instances coming from an application of interest.[2]

Uses

In computer vision this can be helpful in finding the correspondence between multiple images of the same scene taken from different viewpoint.[2] This can be useful for matching a face from the set of samples of faces. This can also be useful for identifying object.
In machine learning, In aligning examples before a meaningful similarity measure can be computed between them.

REFERENCES

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