

Colour Refinement: A Simple Partitioning Algorithm with Applications From Graph Isomorphism Testing to Machine Learning

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Abstract

Colour refinement is a simple algorithm that partitions the vertices of a graph according their “iterated degree sequence.” It has very efficient implementations, running in quasilinear time, and a surprisingly wide range of applications. The algorithm has been designed in the context of graph isomorphism testing, and it is used an important subroutine in almost all practical graph isomorphism tools. Somewhat surprisingly, other applications in machine learning, probabilistic inference, and linear programming have surfaced recently.

In the first part of my talk, I will introduce the basic algorithm as well as higher dimensional extensions known as the k -dimensional Weisfeiler-Lehman algorithm. I will also discuss an unexpected connection between colour refinement and a natural linear programming approach to graph isomorphism testing. In the second part of my talk, I will discuss various applications of colour refinement.

1998 ACM Subject Classification F.2 Analysis of Algorithms and Problem Complexity

Keywords and phrases Color Refinement, Graph Isomorphism, Machine Learning

Digital Object Identifier 10.4230/LIPIcs.FSTTCS.2014.31

Category Invited Talk



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34th Int'l Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2014).

Editors: Venkatesh Raman and S. P. Suresh; pp. 31–31

Leibniz International Proceedings in Informatics



LIPIC Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany