Fine-grained Reductions Around Context-Free Path Querying

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1 INTRODUCTION

1.1 brief description of the problem, areas of usage, idea of solution

cfpq appears in bioinformatics, graph databases, static code analysis
finding valid paths between vertices

1.2 problems with current cfpq results

several cubic algorithms exist
can we do significantly better? no such algorithm had been found for several decades
maybe we can prove that no such algorithm exist under some hypothesis

1.3 main problem

fine-grained complexity has some results in the area
results are scattered, have no structure
maybe everything is already proven

1.4 main goals, overview

collect existing results into easy-to-read form
state open problems

2 PRELIMINARIES

cfg, directed graph, cfl reachability and recognition, note on Dyck-1, fine-grained reduction

3 MAIN RESULTS

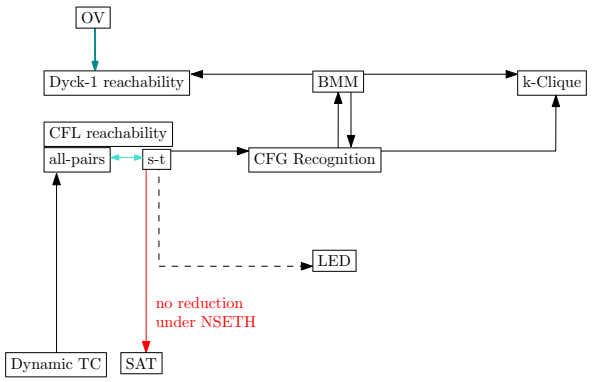

Fig. 1. arrow - reduction the other side. blue arrow - open problem.
!!!check reduction OV to Dyck-1

In [1]

3.1 existing problems and hypotheses

shortly describe problems (OV, BMM, LED, SAT, DTC) on map and hypotheses about them + NSETH

3.2 existing reductions

dynamic TC to all-pairs
BMM to Dyck-1
s-t -> cfg -> bmm => no combinatorial algorithm
short s-t certificates => no reduction from SAT

3.3 OV to Dyck-1

$O(n^{2-\epsilon}) \Rightarrow O(n^{2-\epsilon})$
idea based on reduction APA to Dyck-1

3.4 open problems

global: subcubic cfpq
s-t vs all-pairs reachability: comparison with triangles detection problem

4 CONCLUSION AND FUTURE WORK

part of global work to determine existence of subcubic cfpq algorithm
formalisation of naive reduction LED to s-t
possible reduction form APSP and reformulations

5 ACKNOWLEDGMENTS

REFERENCES

[1] Leslie G Valiant. 1975. General context-free recognition in less than cubic time. *Journal of computer and system sciences* 10, 2 (1975), 308–315.