

Interview Algorithm is in $IP=PSPACE$

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Abstract

This article is a short follow-up to the Interview Algorithm published earlier. An attempt is made to perceive interview with a complexity theory spectacle. Interview is mapped to Arthur-Merlin class of languages and its generalization as interactive proof class (IP) through a reduction. Moreover Interview algorithm is executed on a probabilistic turing machine allowing a bounded error probability.

1 Introduction

Article 1) defined a concept of interview and presented an algorithm for interview of one document by other document through question-answering using some automatically obtained questions or through some predefined reference questions. This extends 1) by analyzing some interesting complexity theoretic properties of an interview.

1.1 Motivation for Interview algorithm (reproduced here for continuity)

Here we map the real world scenario of an interview being conducted on a candidate where a panel asks questions and judges the candidate based on the quality of answers by candidate - candidate is a document and it is "interviewed" by a reference set of authorities. Each document x is interviewed/evaluated by set of reference documents which will decide on the merit of the document x . Reference set initially consists of n user chosen authorities on the subject. Interview is set of queries made by reference set on the document and evaluating the answer to the queries. If x passes the interview it is inducted into reference set. Next document will be interviewed by $n+1$ documents including last selected document and so on. Hierarchy of interviews can be built. For example Document x interviews documents y and z . Document y interviews w and document z interviews p . Thus we get a tree of interviews (it could be a directed acyclic graph too, if a candidate is interviewed by more than one reference, one of which itself was a candidate earlier). The interview scores can be weighted and summed bottom-up to get the merit of the root (Analogy: hierarchy in an organization).

1.2 Steps of the Interview algorithm

1. Relevance of the document to the reference set is measured by a classifier (NaiveBayesian or SVM or search engine results for a query)
2. Intrinsic merit score of the document is computed either by Recursive Gloss Overlap algorithm (measures the meaningfulness/sanity of the candidate) (or) by citation digraph

3. Reference set interviews the candidate and gets the score
4. Value addition of the candidate document is measured (what extra value candidate brings over and above reference set)
5. Candidate is inducted into reference set based on the above criteria if candidate is above a threshold.

2 Interview Algorithm and Interactive Proofs

In complexity theory, Arthur-Merlin or AM is the class of languages with an interactive proof that consists of the verifier sending a random string, the prover responding with a message, and where the decision to accept is obtained by applying a deterministic polynomial-time function to the transcript. The class Merlin-Arthur or MA denotes the class of languages with 2-round public coins (verifier reveals the random string to prover) interactive proof with the prover sending the first message. Interactive Proof or IP class introduces polynomial rounds of Prover-Verifier transcripts. Both Public-coins and Private-coins are being used depending on whether verifier reveals everything to prover or not with not too much of difference in computing power. By intuition there is a notable similarity between Interview Algorithm above which operates on question-answering and Interactive Proofs.

3 Interview algorithm is in $IP=PSPACE$ - proof by reduction

Formalizing the above intuitive similarity, we can map a prover to the interviewee document and verifier to the interviewer document. If interview algorithm in 1) is relaxed to allow a probabilistic turing machine executing the interview, then by soundness, verifier(interviewer) accepts the prover's(interviewee) right answer by probability of atleast $2/3$ and by completeness, verifier(interviewer) accepts the prover's(interviewee) wrong answer by probability of not more than $1/3$. Thus interview algorithm gets less stringent. We assume that Interview algorithm has polynomial rounds. The interview transcript is evaluated by a polytime function which decides on accepting or rejecting the candidate document. Thus we have obtained a reduction from Interactive Proof to Interview algorithm which is executed by a probabilistic turing machine. By this reduction Interview algorithm has been shown to be in $IP=PSPACE$. This can also be proved to be $PSPACE$ -hard by turing reduction from a $PSPACE$ -complete problem. For example an interview can be represented by a totally quantified boolean formula (TQBF) written as

$$\forall question_1 \exists answer_1 \forall question_2 \exists answer_2 \dots \quad (1)$$

and the formula is satisfied based on correctness of answers to the questions

4 Acknowledgement

I dedicate this article to God.

5 Bibliography

References

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