

A Machine Learning Perspective on Predictive Coding with PAQ

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- 1 Introduction to PAQ
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 - Architecture
 - Model Mixer
 - Mixture of Experts
 - Updating & Filtering
- 3 Applications for PAQ8
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Introduction to PAQ

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Introduction to PAQ

What is PAQ8

- What is it?
- How does it work?
- What makes it so famous?

Introduction to PAQ

Matt Mahoney

- Born 1955
- Recieved Ph.D in computer science at Florida Tech in 2003
- Released PAQ1 on January 6, 2002



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What is PAQ?

- A lossless, open-source compression algorithm
- Brings high performance at the cost of increased memory usage and time consumption
- Related to PPM, is envisioned as PPMs improvement

Principles of PAQ

- Modeling combined with adaptive arithmetic encoding
- Open to additions and improvements
- Improves performance of PPM by including several predictors (i.e. models of data)
- Combines the result of the predictors

Exemplary Predictors

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The order- n context predictor

- Examines the last n bits and counts the 1's and 0's
- Estimates probability whether next bit is 1 or 0 like PPM

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The sparse context predictor

- Context consists of a specific amount of non-contiguous bytes before the current bit

PAQ & Predictors

- PAQ encoder looks at the beginning of input file for deciding which predictors are used
- Ways to combine predictions change through with the different versions

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PAQ8 - What's new?

- Predictors don't produce a pair of bit counts anymore
 \hookrightarrow those counts get weighted and normalized into the interval $[0, 1] \subset \mathbb{R}$
- Instead each predictor already outputs a probability
- *paq8l* is a stable version of paq8, released by Matt Mahoney

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PAQ8L - Machine Learning Perspective

- *paq8l* is the version of PAQ used by *Byron Knoll & Nando de Freitas*
- They try to show the possibilities of PAQ beyond data compression

Architecture of PAQ8

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Example

Applications for PAQ8

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