EE274: Course Summary

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EE274 Summary -> IID Data

- **How to compress i.i.d data?**

  Prefix-free codes, Huffman codes, Arithmetic coding, rANS
- Mainly useful as a building block for other fancier compressors

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EE274 Summary -> IID Data

- **Entropy and Information theoretic limits**

  “What is the best you can compress you data?” Entropy

- **Using Information theory for generic lower bounds**

  A very useful technique used in CS Theory etc.. (you got a glimpse from the “find the best rower problem” in HW4)

Q5: Lower Bounds via Information Theory (*35 points*)

At the annual *Claude Shannon rowing contest*, there are n participants, with $n-1$ out of them having exactly same strength but one of the rowers is exceptionally strong. The contest aims at finding that one strongest rower. The competition organizers are unfortunately limited on the funds, and so want to minimize the number of rounds to declare the winner.

EE274 Summary -> Non-iid data (aka real data)

- **Lossless compression of non-iid data:**

  Key-idea -> *“Good predictor => good compressor” (we saw kth order adaptive coders & LLMs!)*

- **What if you don’t want to model your data?**

  Universal Lossless compressors -> can be shown to be optimal *asymptotically* on any source

  LZ77, LZ78, BZIP, ZStandard …

- We ended with some **tips on lossless compression in practice** - always start with zstd and then move ahead with the tips!
  - One key idea: transform your data into a form that existing compressors can work well on!

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EE274 Summary -> Lossy compression fundamentals

- **Rate distortion theory:**

  “What is the fundamental limit on lossy compression given a distortion?”

- **Vector Quantization, Transform coding**

  Theory gets quite difficult when we come to lossy compression :-|

  But, lots of good insights!

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EE274 Summary -> Applications

- **Image compression**

  JPEG, ML-based image compression, …

- **Audio, Video Compression**

  Demo on audio compression, today's lecture…

"Key concepts are kind-of similar across all the domains.. Transform coding, Residual coding, and finally some lossless coding"

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EE274 -> What we didn’t get to

- **Distributed Compression**

  How do we jointly compress data from multiple sources? (Puzzle in HW3 gives a sense)

- **Succinct Data Structures**

  “How can we compress data structures so that they fit on the RAM? But still have their properties intact?” -> eg: searching over compressed text

- **Compression of ML-models, Compression in HW**

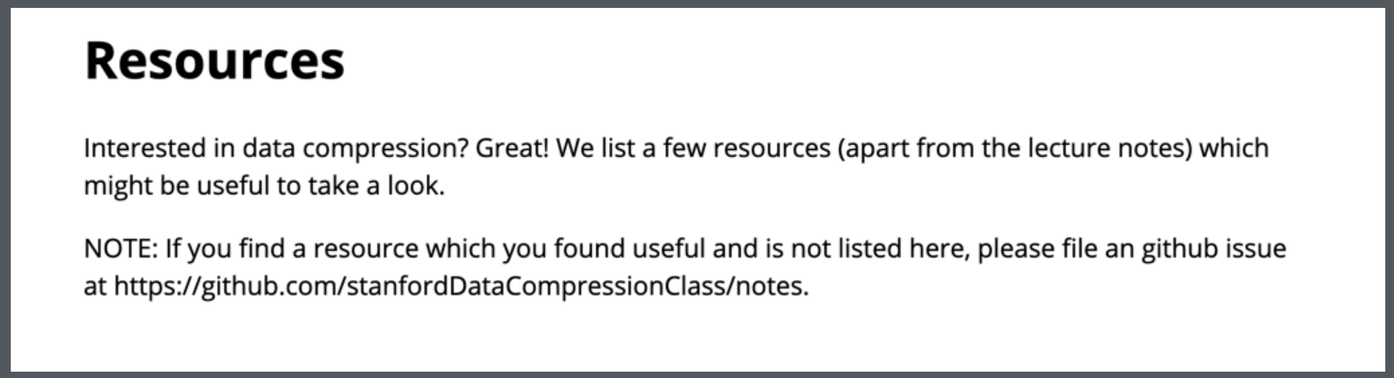
  Very interesting line of work, with lots of interesting problems.

- **Other specific domains - AR/VR, genomics, ...**

EE274 -> What next?

- **Stanford Compression Library**
- **EE274 Resources**

https://stanforddatacompressionclass.github.io/notes/resources.html



Resources

Interested in data compression? Great! We list a few resources (apart from the lecture notes) which might be useful to take a look.

NOTE: If you find a resource which you found useful and is not listed here, please file an github issue at https://github.com/stanfordDataCompressionClass/notes.

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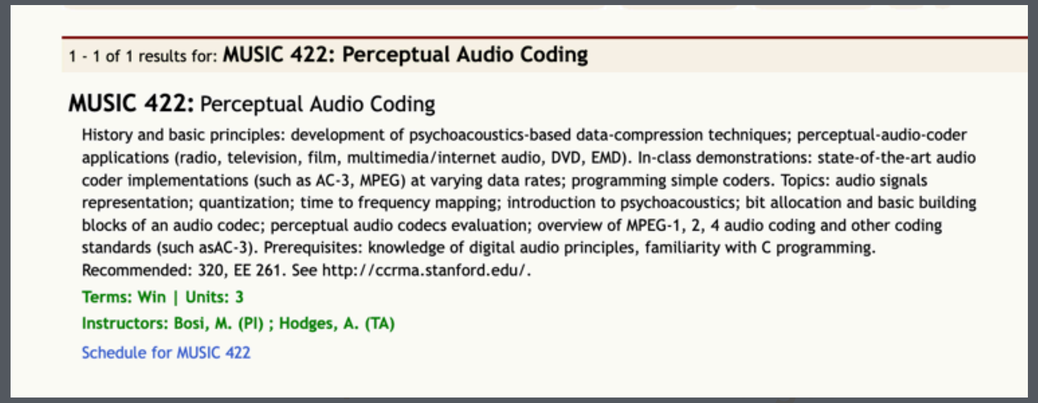
EE274 -> What next?

- **EE276 -> Information Theory**
- **EE376 -> Topics in Information theory**
- **MUSIC 422 -> Perceptual Audio coding**
- **CS 228 -> Probabilistic Graphical Models**

…



1 - 1 of 1 results for: **MUSIC 422: Perceptual Audio Coding**

MUSIC 422: Perceptual Audio Coding

History and basic principles: development of psychoacoustics-based data-compression techniques; perceptual-audio-coder applications (radio, television, film, multimedia/internet audio, DVD, EMD). In-class demonstrations: state-of-the-art audio coder implementations (such as AC-3, MPEG) at varying data rates; programming simple coders. Topics: audio signals representation; quantization; time to frequency mapping; introduction to psychoacoustics; bit allocation and basic building blocks of an audio codec; perceptual audio codecs evaluation; overview of MPEG-1, 2, 4 audio coding and other coding standards (such asAC-3). Prerequisites: knowledge of digital audio principles, familiarity with C programming. Recommended: 320, EE 261. See http://ccrma.stanford.edu/.

Terms: Win | Units: 3

Instructors: Bosi, M. (PI) ; Hodges, A. (TA)

Schedule for MUSIC 422

Thank You!

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