RET Project: Detecting Pneumonia Using Audio Spectral Features

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RET Schedule and Training

- Technical Discussions:
  - Regression, Clustering and Classification, Neural Nets. JDSP
- Embedded Hardware:
  - Software Development for Embedded Hardware
- Video Lectures:
  - Sensors, accelerometers, clinical/social implications,
- Working in a Research Environment
- Sustaining a Technical Vision
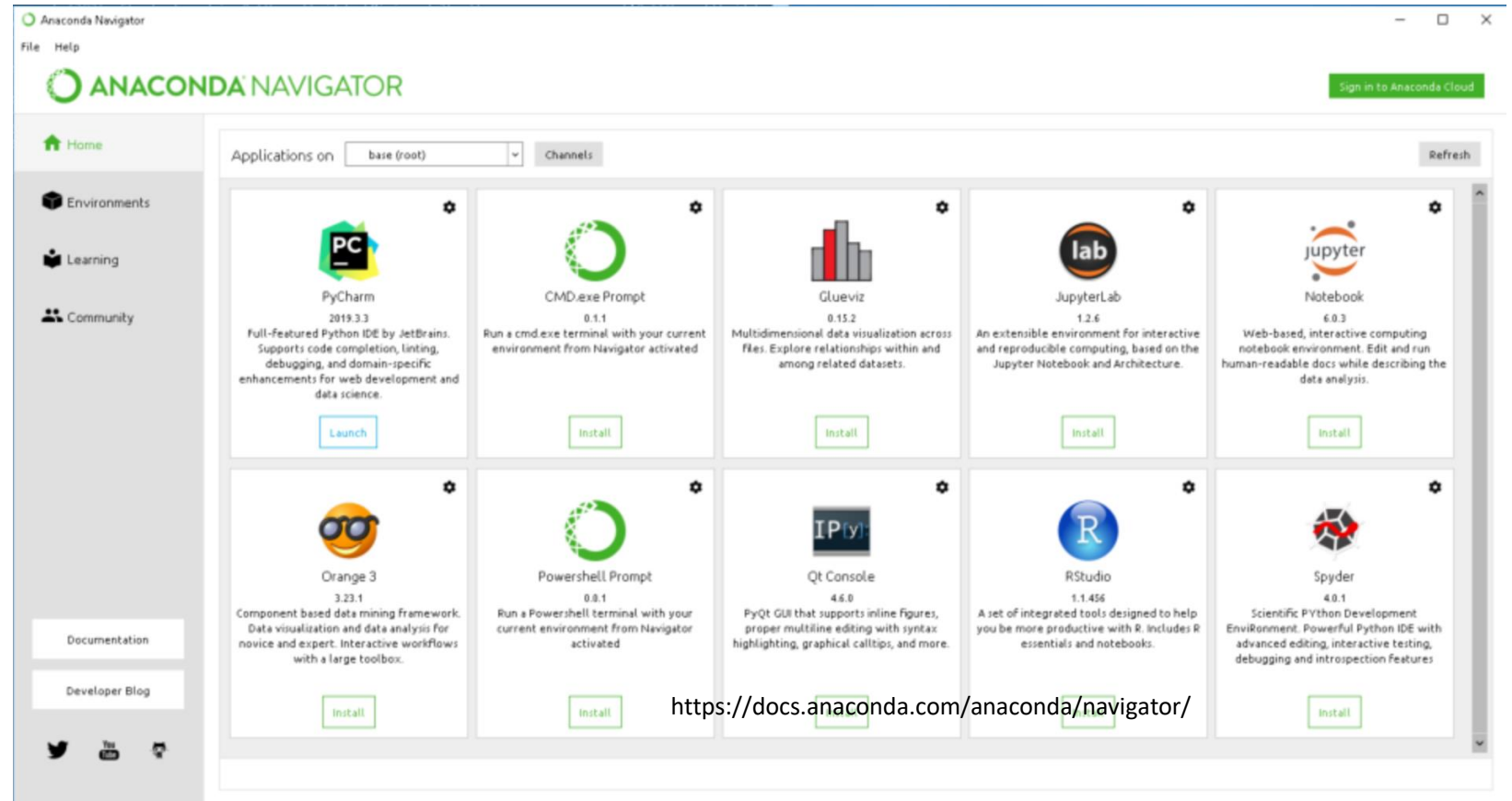- PBL, Careers in STEM

https://lawtomated.com/a-i-technical-machine-vs-deep-learning/
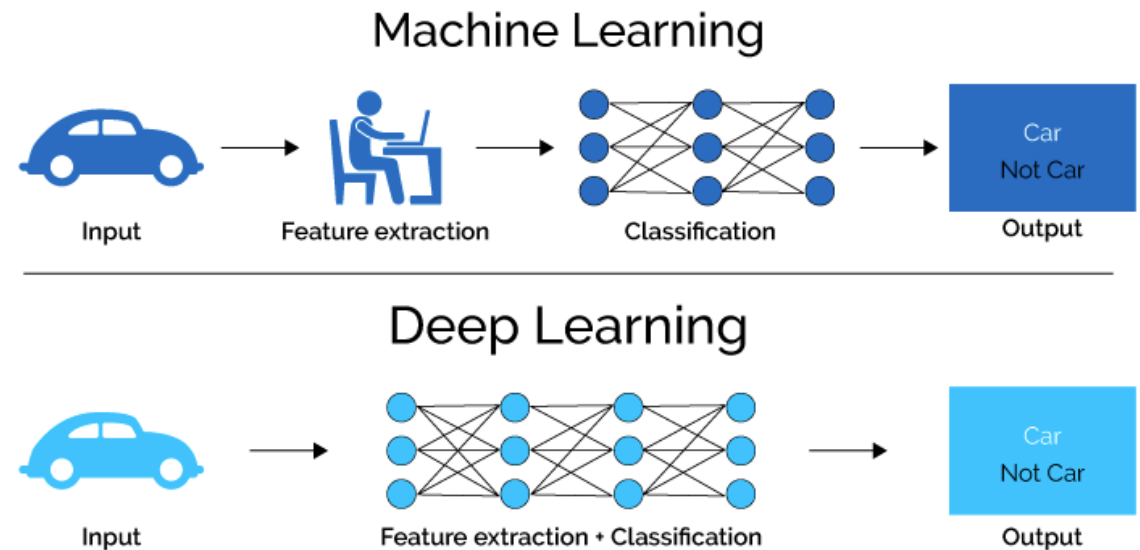
RET Schedule and Training

Research Materials

- Anaconda
- Spyder
- Google Colab
- GitHub
- Google Scholar

https://docs.anaconda.com/anaconda/navigator/

RET Lab Experience Research Summary

Problem:
- How can we use machine learning to detect respiratory pathologies?

What has already been done?
- COVID-19
- Smoking induced respiratory changes
- Identifying tuberculous pleural effusion

Plan:
- Obtain data from audio databases of breathing cycle sounds
- Used spectral estimation and customized statistical features
- Challenge: bias in data set
- Use neural network methods to classify audio samples
- Output diagnosis / confusion matrix
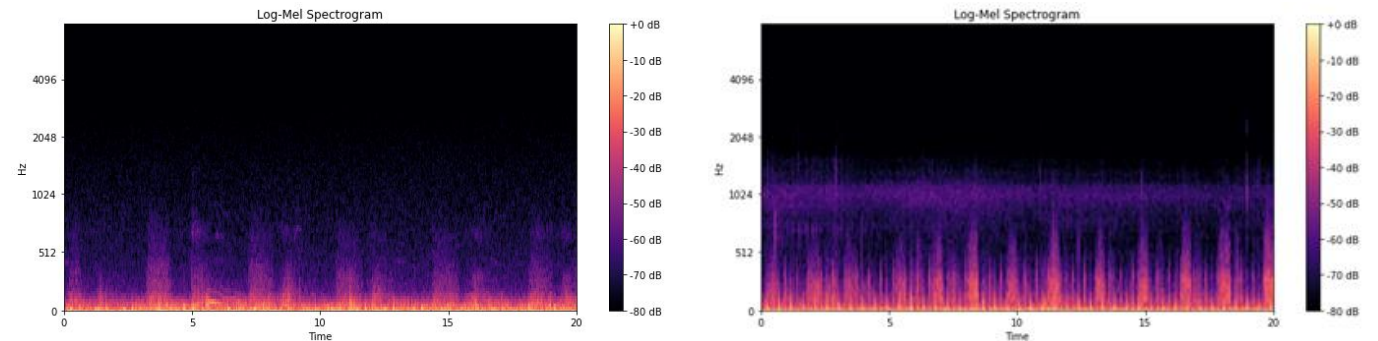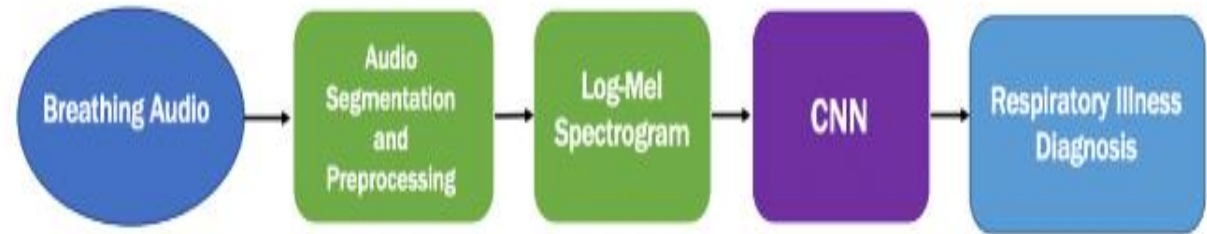
RET Lab Experience Research Summary

Research Conclusions

- 75% accuracy

- Dataset must not be biased

- Options if data is biased:
  - Curate (worked best in this case)
  - Re-run model with a different loss function (focal loss)

- Future applications:
  - Sift through large quantities of data in less time
  - Human specialists
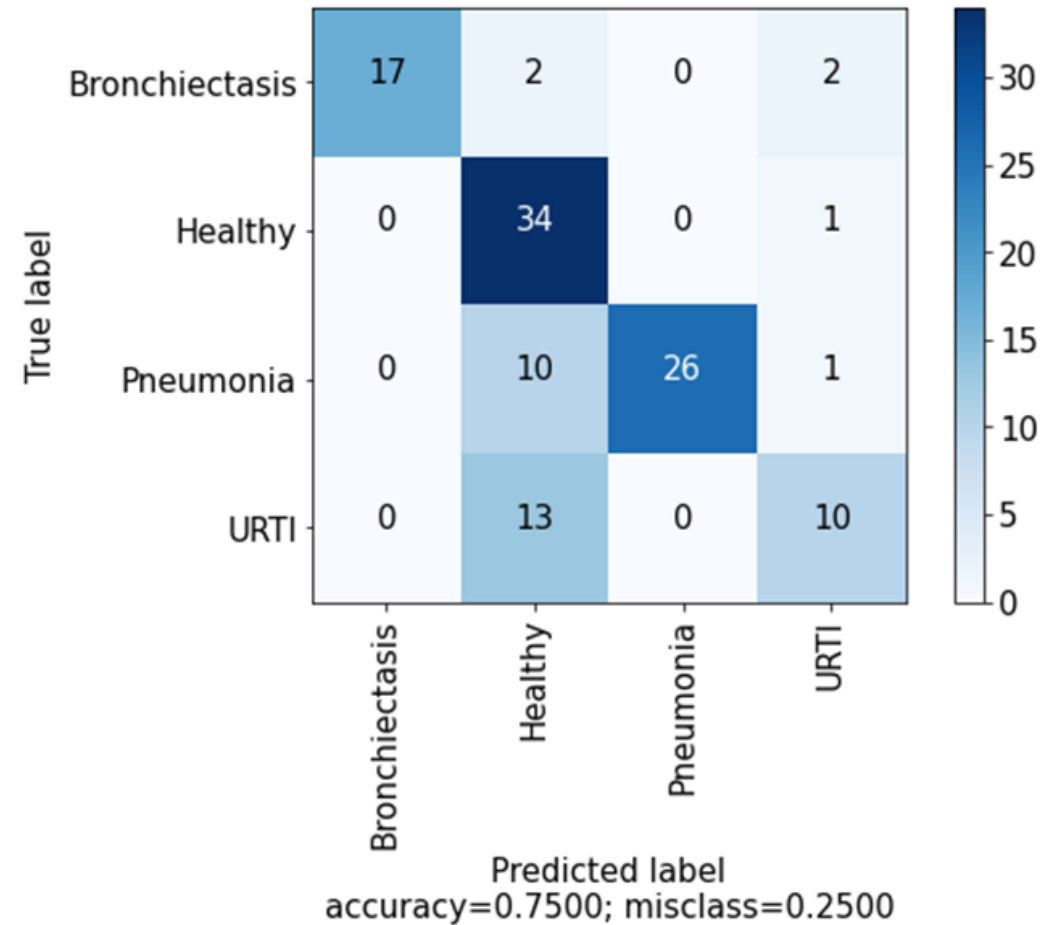
RET Instructional Lesson Implementation

- **Standard:**
  - Develop and use a model to explain how cells, tissues, and organ systems maintain life (animals).

- **Objectives:**
  - Students will create a model of the respiratory system and structures involved.
  - Students will determine how pneumonia affects these structures. (maintain life)
  - Students will attempt to detect pneumonia using audio samples and spectrograms in hopes to compete with a machine learning algorithm.

RET Instructional Lesson Implementation

Lesson Description

- Prior to lesson:
  - Build a model of a lung and label structures
  - Determine what can happen when structures in lungs aren't functioning properly

- Lesson:
  - Spectrograms
  - Listen to audio samples (in partners) and view spectrograms to look for trends in order to detect pneumonia
  - Machine learning intro
  - See how their accuracy compares
  - Discuss future clinical applications of this research and its impact on society

https://sensip.engineering.asu.edu/ret/

ANY QUESTIONS?

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https://sensip.engineering.asu.edu/ret/

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