S.M.A.R.T Goals

Wednesday, March 27, 2024 2:31 PM

specific
measurable
achievable
relevant
time-bound

goals are intended to focus attention and resources on what is most important so that you can be successful in achieving your priorities

where to start:

1. what are the broad areas? (look at grading rubric)
2. develop a goal statement from each area. focus on end results - not tasks
3. goals are a balance - high level enough to target core outcomes, but specific enough to know you've succeeded
4. have too many goals? you're probably listing tasks
5. think about combining tasks under a single goal umbrella

starter goal: get comfortable with unix? efficient programming applications?

v.2 learn how to use data analysis to make conclusions about my questions

v.3 successfully execute an efficient algorithm to make specific observations from the data by the end of the project

v.4 successfully use applications from my other classes to develop and execute an efficient algorithm that makes specific observations from the data by the end of the project (and feeling confident about it!)

v.5 feel confident in applying machine learning and statistics applications to develop and execute an efficient algorithm to make specific observations from the data by the end of the quarter

A good outline for the paper is also a good plan for the research program.

- Make an outline before starting the research and follow it during! Makes the paper writing process easier later
- organize data around visualizations AND in order of importance, not chronological order

In-class practice writing an outline for a *fake* research paper

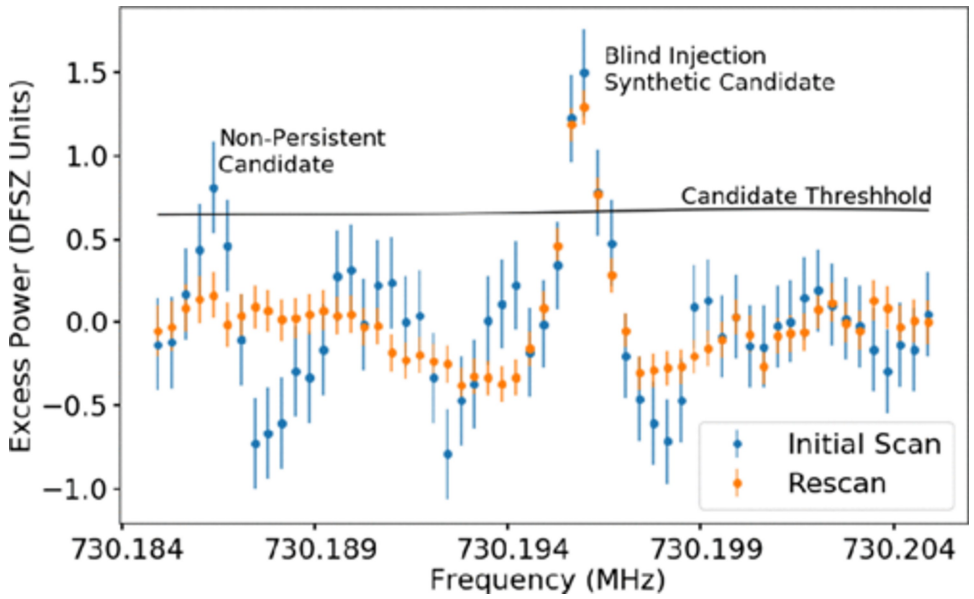
Step 1: Brainstorming

- what is interesting to you?
    - naps during the school day
    - dark matter
    - binary systems with black holes
- what questions do you have?
    - dark matter

        - what is it
        - how can we figure out what it is
        - what wavelengths is it detectable (if even)?
        - how do we know it's real and not some error?
        - what's an axion? is it real or hypothetical?
    - binary systems with black holes
        - how does the star not just go in?
        - how long can a star be there before it's depleted?
        - how many binary systems are actually black holes?
        - what other ways can you classify black hole binaries other than light curves and gravitational lensing?
- what objects or processes do you want to learn more about?

Step 2: Outline the Paper

- pick a topic (one where you can get a plot or two off the internet later)
- fill out the outline as described in Whitesides, adjusted slightly for astronomy
    - title: What's an Axion?
    - authors: Emma and Maggie
    - abstract:
        - axions are hypothetical but will change nuclear physics and dark matter
        - axions converted to photons emit frequencies, changing the environment to match the frequencies results in a release of power
        - havent discovered axion yet because power observed is not the power expected at matched frequencies
    - introduction:
        - objective: learn more about an axion, have a breakthrough in physics
        - justification
            - hypothetical particle that could solve problems in nuclear physics
            - possible component of cold dark matter
            - could be a breakthrough for dark matter and other areas of astrophysics
        - background
            - Peccei-Quinn theory was proposed to solve CP problem
            - ruled out with newer model of similar mechanics
        - guidance
            - reader should watch for the difference between synthetic and natural photons (i.e. control vs experimental data)
        - summary
            - axions are hypothetical way that could potentially explain problems in nuclear physics
            - could also be the connection to dark matter
            - using a haloscope to compare frequencies that can reveal an expected amount of power confirming whether or not axions are real
    - data/experiment/observations (describe experiment)
        - strong magnetic field to convert axions inside a cavity into photons to make them detectable - this device is called a haloscope
        - these photons emit a frequency, then the environment inside the cavity is changed to match this frequency
        - after matching frequencies, there's an expected amount of power that's supposed to be detected
        - the power observed is not the power expected at matched frequencies
        - lab at CENPA



- results and discussion (data analysis)
  - haven't discovered the axion yet because the results haven't met the expectation of what the amount of power is supposed to be
- conclusion
  - need better technology, more breakthroughs in research
  - more money and time
  - can send a haloscope into space to escape earth particle interactions