



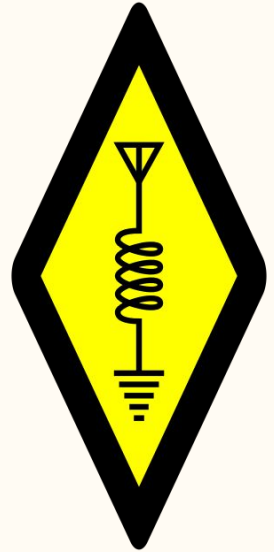
Smart Retrieval and Recommendation for Ham Radio

Pairing Users with Radios with Repeaters



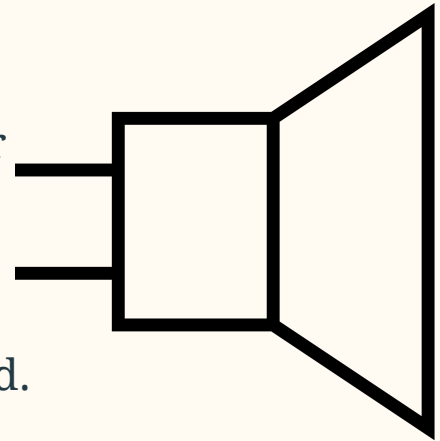
What is Ham Radio?

- A network of licensed amateur radio operators partly organized by the FCC and partly by organizations like the ARRL.
- Communication takes place in the form of talk, text, image, and International Morse Code.
- The hobby combines knowledge of electrical engineering, wave propagation, and communication protocols.
- Many amateurs rely on locally operated “repeaters”.



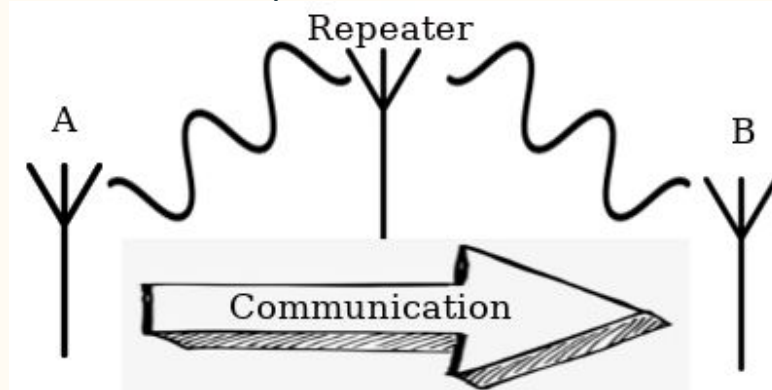
What is a Repeater?

- A repeater is a device that receives a signal on one frequency and repeats it on a another, allowing that signal to travel farther with greater clarity.
- Many repeaters are operated by local clubs and there are few online tools for finding what is available to users.
- Some radios can “talk” for thousands of miles from the transmitting station but these generally require a higher class of license to use.
- Many Ham Radio operators utilize sets which can only transmit for 20 to 50 miles, making these repeaters necessary for communicating outside one neighborhood.



Scope of Project:

- Create a searchable directory of repeaters that takes user input of a location and a token-izable query string.
- Use frequent pattern mining to generate a recommendation for the user of the most common types of repeaters in their area.
- Make these resources easily available online.



What distinguishes a Station?

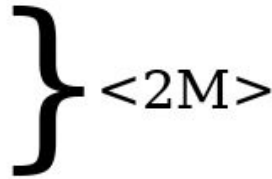
- **Frequency:** the particular vibrational rate of the wave carrying a signal, expressed in Megahertz. Often separated in “bands” which are groups of close frequencies described with a wavelength. Such as:
 - 2 meter: 144 - 148 MHz
 - 70 centimeter: 420-450 MHz
 - Visible Light: 430,000,000 - 707,000,000 MHz
- **Mode:** the way that a signal is encoded into the carrier frequency. Can be analog (as with AM and FM) or digital (as with DSTAR or DMR).
- **Squelch:** a method of removing noise from voice transmissions. Common methods are tones and carrier codes.

Implementation:

- Digitize the Texas section of the ARRL repeater guide.
- Use the user-input **locations** to select a pool of candidate stations from the CSV stored on the web-server.
- Tokenize the user-input query and the candidate pool on the basis of Band, Mode, and Squelch.
- Present up to 10 stations ordered by the Jaccard similarity of the query tokens and the candidate tokens.
- Apply A-Priori pattern mining to the full pool of candidate tokens.
- Present the most frequent combinations of Band, Mode, and Squelch type.

Tokenization:

- Input strings (both query and candidate) are compared to a series of regular expressions.
- Flexibility is important because there is no universal format for inputting some information.
- Example strings which tokenize to the 2M Band:
 - “145.49”
 - “147.22 MHz”
 - “2M”
 - “2 meter”



} <2M>

A-Priori Recommendations:

- Generate candidates token lists by self combination.
- Pruning was considered but removed after the small set sizes proved that it was requiring more work than it was saving.
- Compare candidates to token lists of the full, location-based pool and remove any that fail to meet the Minimum Support.
- Repeat until no candidates pass the min-sup requirement.
- Present that previous candidate to the user.

Example Search:

- Location: Bryan and Abilene
- Query: 2m, fm
 - Generates tokens <2M> and <FM>

Directory of Texas UHF/VHF Repeaters

Yellow Diamond amateur radio symbol

This simple directory is intended to help users find amateur repeaters in the state of Texas. To use this directory, enter a location or string of locations separated by commas. You can also enter information such as mode, band, and squelch in the search box.

Location:

Station Type:

Example Results:

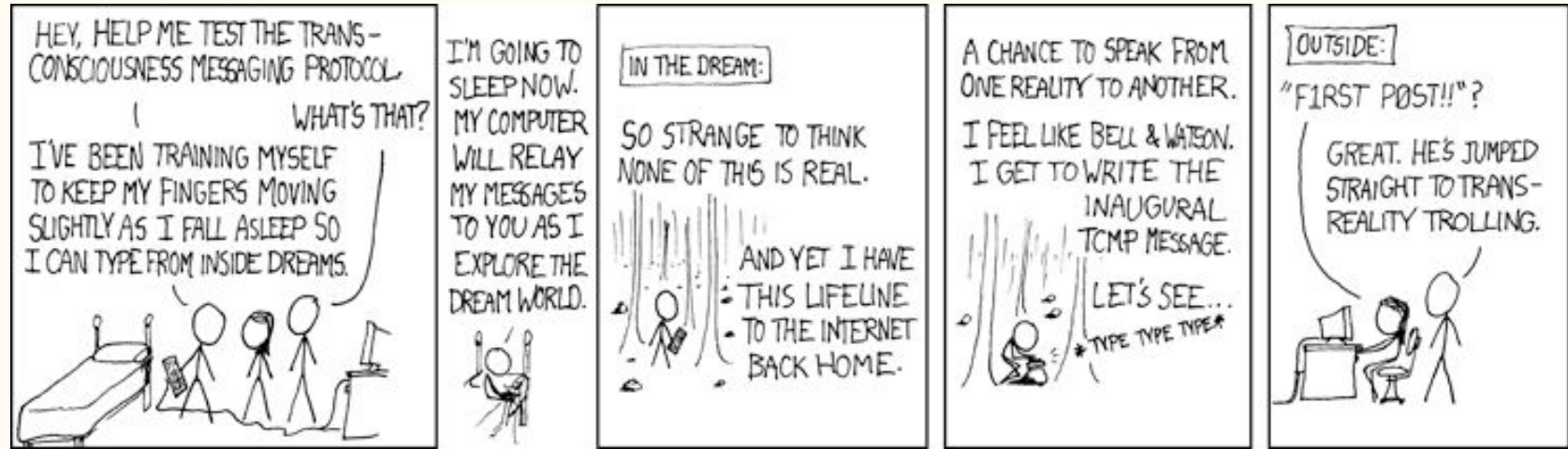
Printing the top 10 results:

City	Mode	Call Sign	Frequency	Offset	Squelch
BRYAN	FM	W5BCS	146.68	DOWN	88.5 HZ
ABILENE	FM	K5CCG	444.425	UP	146.2 HZ
ABILENE	FM	KC5OLO	14696	DOWN	146.2 HZ
ABILENE	FM	KC5PPI	145.35	DOWN	110.9 HZ
ABILENE	FM	KI5ZS	145.49	DOWN	88.5 HZ
ABILENE	FM	KC5OLO	146.76	DOWN	146.2 HZ
ABILENE	FM	W5TNJ	146.8	DOWN	88.5 HZ
ABILENE	FM	KE7JHC	441.05	UP	*
ABILENE	FM	KB5GAR	444.75	UP	88.5 HZ
BRYAN	FM	N5ZUA	443.475	UP	103.5 HZ

The best radio to purchase is your area should support:

- 70CM
- FM
- TONE_SQUELCH

Question or Comments?



Search tool available at: <https://userweb.cs.txstate.edu/~gma23/directoryHome.html>

Code available at: https://github.com/gentry-atkinson/cs7312_assignments