**Homework 5 (Psych186B, Fall 2019)**

**Federation Intelligence Exercise (30 points)**

**Posted on October 16, 2019; Due 1159pm, Nov 8, 2019**

As intelligence officer on the *Enterprise* it is your job to incorporate the latest intelligence information into the shipboard neurocomputer. Assume that a sudden ionic storm off Delta Scuti, where the *Enterprise* has been patrolling, has destroyed the main neurocomputer.

All that is left that can be used for intelligence estimates is the archaic Dell PC in the ship's museum plus some antique early 21st century neurocomputing software apparently written for class assignments at Brown University, an institution coated with Ivory that later became a module in the East Coast Advanced Information Content Provision Complex. This material had been inadvertently left on the disk drive when the PC was decommissioned in 2006.

It is essential that you be able to tentatively identify ships based on sensor scans so that the Enterprise will be able to take appropriate action when another ship approaches.

Though recent political changes in the **Klingon** Empire make Klingons less of an immediate danger than in the past it is still necessary to be wary, because of the presence of Klingon extremist factions that may attack Federation ships without warning. Detection of a Klingon ship in the current political climate, therefore, requires the Enterprise to ready the photon torpedos and the phasors in the expectation of hostile actions.

**Romulans** are tricky to deal with. They are touchy, deceitful and arrogant. Their presence requires that the Enterprise enter a state of heightened alertness but not engage in active preparations for hostility.

**Federation** starships are, of course, friendly.

**Antareans** are usually friendly, but if they detect that the Enterprise has entered a warlike mode, for example by arming the photon torpedoes, an act that can be detected by their sensors, they take this as a grievous insult, a reflection on their honor, and will immediately commence hostilities.

It is unlikely that a previously identified ship will be encountered. However, some accurate information about a small number of ships escaped the ion storm.

Your job is to train the old neurocomputer program (or a modern system, if you own it) so it can make the correct decision most of the time when a new ship is sighted. You probably could use simpler pattern recognition techniques for this problem, but Capt. Picard and Science Officer Data insist that you use the neurocomputer so they can compare it with the analysis provided by the main computer on the *Enterprise*.

It need hardly be mentioned that an incoming ship, particularly when far away, may be generating noisy sensor readings that sometimes give misleading or partial information. You should be able to take this partial, noisy information and (in descending order of importance) tell:

1. Whether the incoming ship is liable to be hostile or peaceful.
2. Whether the Enterprise should enter a state of heightened alertness.
3. The tentative identification of the ship’s system of origin.

In summary, there are four systems represented Klingon, Romulan, Antarean, and Federation. The Enterprise has to be prepared to take appropriate action when the system of origin is identified. Klingons are to be treated as hostile. Romulans require Alert status. Antareans and the Federation must be considered friendly.

Data from previous encounters provides enough information to characterize new ships, even in corrupted form.

**Archival Intelligence Data Table for Training Neural Network**

Name | Planet of | Warp Drive | Hailing | Surface | Ratio | Req.|

| origin | Vibration | Transponder| Reflect.| of long |action|

| | Index | Freq. | (color) | to short| |

| | (Murds) | (gigaHz) | | axis | |

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Grotz Klingon 6.9 1006.4 Black 3.5 Hostile

Tlarr Klingon 7.0 994.3 Black 2.3 Hostile

Tribok Klingon 7.3 978.1 Dark Gray 2.8 Hostile

Brogut Klingon 7.1 1005.4 Dark Gray 3.0 Hostile

Glorek Klingon 7.1 1001.8 Light Gray 1.0 Hostile

Lorif Romulan 7.3 980.4 Dark Blue 1.6 Alert

Rallev Romulan 7.4 977.2 Dark Green 1.8 Alert

Willosh Romulan 7.3 947.9 Light Gray 1.9 Alert

Loshar Romulan 7.2 955.8 Light Blue 2.1 Alert

Sarash Romulan 7.4 960.7 Light Gray 2.3 Alert

A2231 Antarean 6.7 1010.9 Pink 1.2 Friendly

E7763 Antarean 6.8 1033.2 Orange 1.2 Friendly

E9091 Antarean 6.5 1025.4 Light Blue 1.1 Friendly

A0199 Antarean 6.8 1066.2 Yellow 1.3 Friendly

A1091 Antarean 6.7 1015.0 Light Blue 1.0 Friendly

Daisy Federation 6.7 1050.0 White 1.9 Friendly

Rosehip Federation 6.8 1055.0 Light Gray 2.0 Friendly

Gardenia Federation 6.5 1045.0 White 2.1 Friendly

Herb Federation 6.4 1065.0 Light Gray 2.6 Friendly

Cinnamon Federation 6.5 1055.0 Light Gray 1.7 Friendly

We are assured by Starfleet Command that this is a fair and representative set of ships. We can use them to faithfully represent the navies of their planets of origin. Note though, that the *Glorek* is atypical in some respects. For one thing, it is nearly spherical, much more typical of the peaceful Antareans, who like round or nearly round ships because they remind them of the Original Egg, progenitor of the Antarean species, laid in the primeval mud of Antares by the ovipositor of the Goddess. In fact, the *Glorek* actually is a captured Antarean ship, the *E3120*. The *E3120* was captured by the Klingons during the Xenoclone wars, repainted, refitted with a Klingon warp drive, and renamed the *Glorek*, after one of the legendary battle chieftains of Klingon prehistory. Re-use of the spoils of war is common in the Klingon space force since it displays an appealing combination of dominance and fiscal economy.

The testing set provided for the exercise consists of 20 sets of partial information, which the main Enterprise computer has provided for you, to correspond to the kind of noisy data that would be seen in reality.

Your job is to determine:

1. Whether the incoming ship is liable to be hostile or peaceful.
2. Whether the Enterprise should enter a state of heightened alertness.
3. The tentative identification of the ship’s system of origin.

Sometimes only a few letters of the name of the ship can be retrieved from the automatic transponder, or the hailing transmitter is not readable, or the color of the ship or its shape can be only crudely discerned.

The main computer would like to observe that use of the regularities in the data from the 20 known ships lead to correct identification of response and planet of origin of all 20 ships the first time the programs were run. However, it is possible that as few as 18 completely correct answers might be obtained with a good coding and proper programming because of the statistical nature of the samples.

Naturally, the intelligence officer will provide the output data from the programs to the exercise adjudicators and write a report in proper Federation format.

**Intelligence Table: Noisy Data for Classification**

Name | Planet of | Warp Drive | Hailing | Surface | Ratio | Req. |

| origin | Vibration | Transponder| Reflect.| of long |Action|

| | Index | Freq. | (color) | to short| |

| | (Murds) | (gigaHz) | | axis | |

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\_\_\_\_\_\_ ? 7.3 \_\_\_\_\_ Light Gray 2.1 ?

\_\_\_\_\_ ? 6.6 1065.0 White 2.1 ?

Lil\_\_\_ ? 6.7 1045.0 White \_\_\_ ?

\_\_\_\_\_\_ ? \_\_\_ 1065.0 Light Color \_\_\_ ?

Pl\_\_ik ? 7.0 1006.3 Dark Color \_\_\_ ?

\_\_\_\_\_\_ ? 7.3 951.4 Green 1.9 ?

Krotork ? 7.0 1001.8 Light Gray 1.0 ?

Woshif ? \_\_\_ 971.7 Blue 1.7 ?

Kritop ? 7.2 \_\_\_\_ Dark Gray 2.9 ?

C06\_\_ ? 6.7 \_\_\_\_\_\_ Orange \_\_\_ ?

\_\_\_\_\_ ? \_\_\_ \_\_\_\_ Black 2.6 ?

G\_\_rk ? 6.9 >1000 Black or Dk Blue 3.2 ?

\_9e\_\_ ? 6.6 \_\_\_\_\_\_ Light Blue 1.2 ?

\_6\_\_\_ ? 6.6 \_\_\_\_\_\_ Orange \_\_\_ ?

Rash\_\_ ? \_\_\_ 955.8 Light Blue \_\_\_ ?

Sor\_\_\_ ? 7.4 <1000 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_ ?

A\_\_\_\_ ? 6.8 1013.3 Light Color 1.0 ?

E4511 ? \_\_\_ \_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_ ?

\_\_\_\_\_\_ ? \_\_\_ >1000 Light Color 1.7 ?

Mor\_\_\_ ? 6.4 1055.0 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_ ?

**You must use a neural network to complete this assignment.**

A few things to consider:

* How to represent the different ship features in your input vectors. You will need to convert the strings to some numerical value, but how? You are not allowed to use conditional statements, such as “if (feature = ...), then it is (ship classification)”.
* How to represent the ship classification in your output vectors
* How to deal with the missing data entries (e.g., missing letters in ship name, uncertain ship color, interval for frequency)