IRRIGATION RECOMMENDATION SYSTEM

SOFTWARE TESTING DOCUMENT

Version 1.9

12/6/2017

VERSION HISTORY

ID & Version #	Prepared By	Revision Date	Approved By	Approval Date	Reason
1.0	Raulie Raulerson	10/31/2017	Raulie Raulerson	10/31/2017	Initial version
1.1	Raulie Raulerson	11/1/2017	Raulie Raulerson	11/1/2017	Completed test cases 1-5
1.2	Raulie Raulerson	11/8/2017	Raulie Raulerson	11/8/2017	Completed test cases 6-11
1.3	Raulie Raulerson	11/11/2017	Raulie Raulerson	11/11/2017	Added section 6.1.2
1.4	Raulie Raulerson	11/13/2017	Raulie Raulerson	11/13/2017	Added section 6.1.3
1.5	Raulie Raulerson	11/15/2017	Raulie Raulerson	11/15/2017	Added section 6.1.4
1.6	Raulie Raulerson	11/17/2017	Raulie Raulerson	11/17/2017	Added section 6.1.5
1.7	Raulie Raulerson	11/18/2017	Raulie Raulerson	11/18/2017	Added section 6.1.6
1.8	Raulie Raulerson	11/19/2017	Raulie Raulerson	11/19/2017	Added appendices A and B
1.9	Raulie Raulerson	12/6/2017	Raulie Raulerson	12/6/2017	Added deployment testing

TABLE OF CONTENTS

1 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to specify the testing requirements for the project entitled Interpreting Soil Moisture Sensor Data to Provide Irrigation Recommendations to South Florida Users (IRS project). This will entail testing the system features laid out for the IRS project in the Software Requirements Specification (SRS) and Software Design Document.

2 TESTING FEATURES

2.1 PROJECT DESCRIPTION

Having an adequate water supply is an important issue that all Floridians must address soon. One new technology that is an innovative tool for conserving water is the soil moisture sensor (SMS). This technology has the potential to significantly reduce a user's water usage, when irrigating, by allowing accurate measurement of the moisture content of the soil, how deep the water content has permeated, the soil's temperature, and even the soil's electrical conductivity (EC). One of the biggest challenges that threatens the use of this tool is the difficulty of interpreting the data produced by these sensors. This affects both agricultural producers and well informed urbanites.

This project will focus on the interpretation and analysis of the data provided by the soil moisture sensor(s) and other site-specific monitoring devices (i.e., weather stations). The project will utilize a recurrent neural network to analyze input data from these sensors, and other devices, to provide a recommendation to the user about how best to operate their irrigation system. More specifically, this project will entail gathering and defining the

requirements for this software system, completing the design for the system, and implementing the system.

2.2 SYSTEM FEATURES TO BE TESTED

System Feature #	Item to Test	Test Description	Test Completion Date	Responsibility
1	Enter Required Data into GUI	See section 6.1.1	11/7/17	Raulie Raulerson
2	Upload SMS and weather data	See section 6.1.2	11/11/17	Raulie Raulerson
3	Train the RNN/Model	See section 6.1.3	11/13/17	Raulie Raulerson
4	Save the RNN/Model parameters	See section 6.1.4	11/15/17	Raulie Raulerson
5	Load Parameters from Previous RNN/Model Run	See section 6.1.5	11/17/17	Raulie Raulerson
6	Generate Irrigation Recommendation Report	See section 6.1.6	11/18/17	Raulie Raulerson

2.3 ITEMS NOT TO BE TESTED

Item Not to Test	Comment
Printing irrigation report	This functionality must exist independent of the IRS system's required functionality. The IRS system will produce a .txt report, so users can print the report if they've previously setup a printer on their system

Different file formats for uploaded SMS and weather data	This functionality was tested quickly, but not documented here. Doesn't fit into the format of the STD well.

2.4 TEST APPROACH(S)

2.4.1 Tests to be Conducted

2.4.1.1 Unit/Component Testing (manual)

2.4.1.2 Functional Testing (manual)

2.5 TEST PASS / FAIL CRITERIA

2.5.1 Unit/Component Testing

Tests for each unit/component must satisfy each stimulus/response sequence and every functional requirement identified in this project's SRS. Each component should also exit in a resilient manner and alert the user if their entered data doesn't conform to the minimum requirements.

Unit/components will fail to pass the testing phase if, and will be labeled as defective, if they don't successfully achieve all requirements listed in each system feature's stimulus/response sequence and every functional requirement listed for the feature.

2.5.2 Functional Testing

Functional testing will consist of ensuring that the system acts as designed. To pass this phase of testing, the IRS system will have to meet the requirements of Figures 2 and 3 (sequence diagrams) in the Software Design Description (SDD) that detail how the system has been designed to function. The IRS system will pass this phase of testing if it adheres to the general sequence detailed in these figures.

If the sequences outlined in Figures 2 and 3 of the SDD are not met, the functional testing phase will need to be suspended and integration testing will begin (i.e., testing individual subsystems) to determine which subsystems are not meeting the system's intended design. Once integration testing is completed, functional testing will continue.

2.6 TEST ENTRY / EXIT CRITERIA

Unit/component testing will begin with System Feature 1. Subsequent features will not be able to be tested until the preceding system feature passes its testing. For example, system feature 3 cannot be tested until it is confirmed that system feature 2 works properly (i.e., cannot train the RNN unless SMS and weather data is uploaded to the system). This phase of testing will be completed once each feature adheres to the requirements in this project's SRS.

Functional testing will not be able to begin until all unit/component testing is completed. This testing phase will be completed once Figures 2 and 3 in the SDD are conformed to.

2.7 TEST DELIVERABLES

No deliverables will be created outside of this document. The outcomes of the unit/component and functional testing phases for this project will be listed in Seciton X of this document.

2.8 TEST SUSPENSION / RESUMPTION CRITERIA

Functional testing will be suspended if the sequence diagrams in Figures 2 and 3 of the SDD are not met. if this happens, integration testing will begin to determine/fix the subsystems not meeting the system operations laid out in Figures 2 and 3. Once integration testing is completed, functional testing will resume.

There are no plans to suspend unit/component testing since the project manager will address deficiencies when encountered for a particular unit/component.

3 RISK AND MITIGATION

3.1 TEST RISKS / ISSUES

No risks or mitigation plans are listed in this document. Please see the Risk Management Plan for Interpreting Soil Moisture Sensor Data to Provide Irrigation Recommendations to South Florida Users (see reference in Appendix X) for details about the risks and mitigation plans for this project.

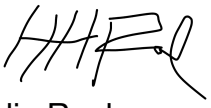
4 ROLES AND RESPONSIBILITIES

4.1 ROLES AND ASSIGNED RESPONSIBILITIES

Role	Responsibility
Tester	All testing
Programmer	Fixing any bugs that are discovered
Project Manager	Compiling STD

5 SOFTWARE TESTING DOCUMENT APPROVAL

The undersigned acknowledge they have reviewed the *IRS Project's Software Testing Document* and agree with the approach it presents. Any changes to this Requirements Definition will be coordinated with and approved by the undersigned or their designated representatives.

Signature: 

Name: Raulie Raulerson

Role: Project Manager

Date: 12/6/2017

Signature: 

Name: Katie Hallas

Role: Client

Date: 12/6/2017

6 TESTING RESULTS

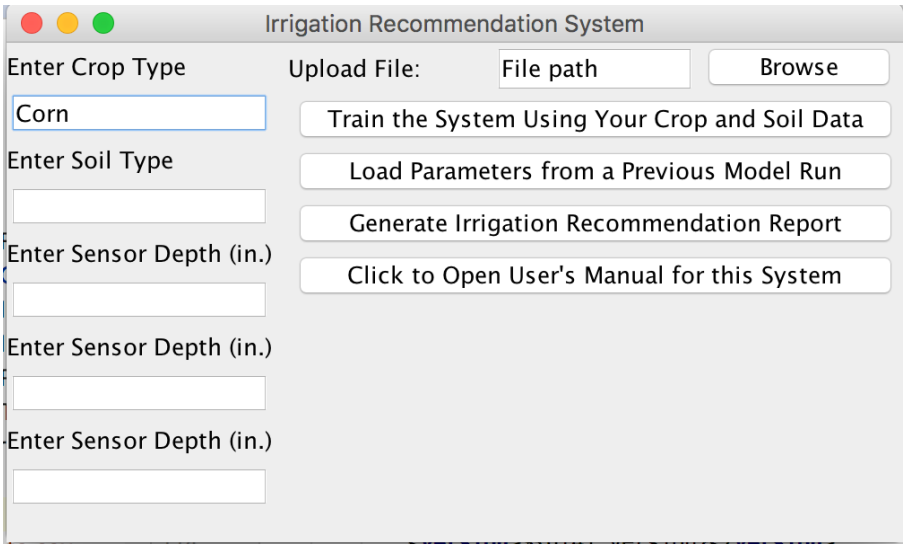
6.1 UNIT TESTING

6.1.1 System Feature 1 - Enter Required Data into GUI

6.1.1.1 Stimulus/Response Sequence

- User inputs crop type in Crop Type field.

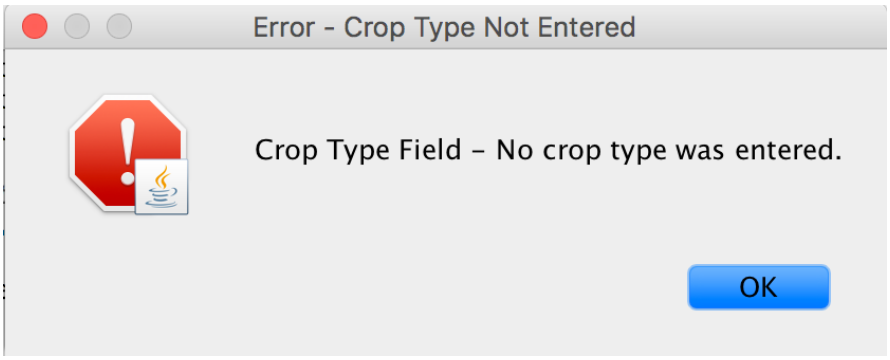
Test Case 1: Crop Type Entered in GUI



Test Case Results:

Test Case 1 tested on 10/31/17. Test case passed.

Test Case 2: Crop Type Not Entered in GUI



Error received when “Train the System Using Your Crop and Soil Data” (aka train button), “Load Parameters from a Previous Model Run” button (aka load button) button, or “Generate Irrigation Recommendation Report” (aka generate button) buttons are selected with no sensor depths entered.

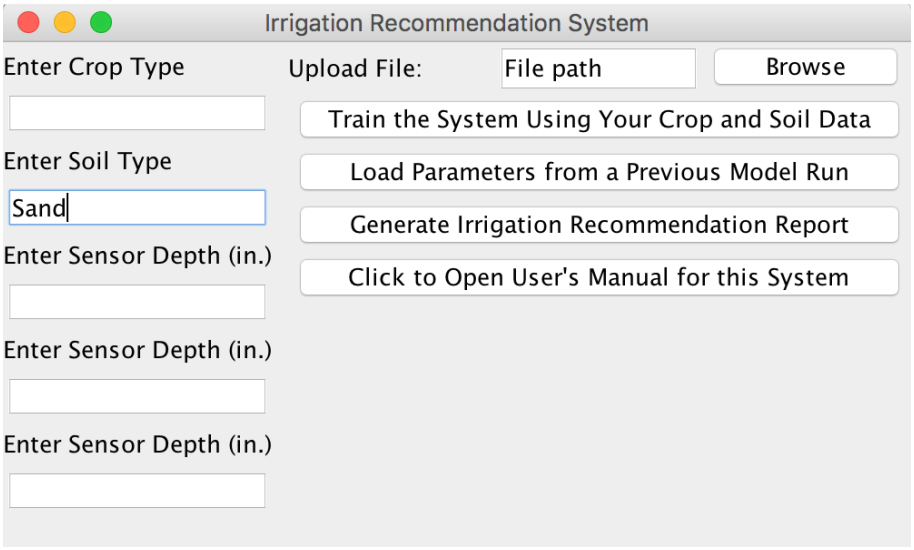
Test Case Results:

Test Case 2 tested on 10/31/17. Test case passed.

****

- User inputs soil type in Soil Type field.

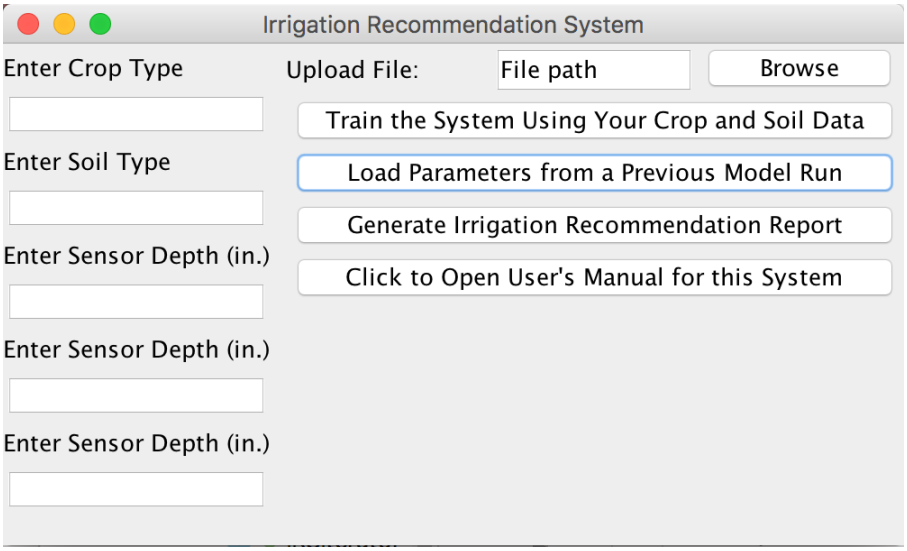
Test Case 3: Soil Type Entered in GUI

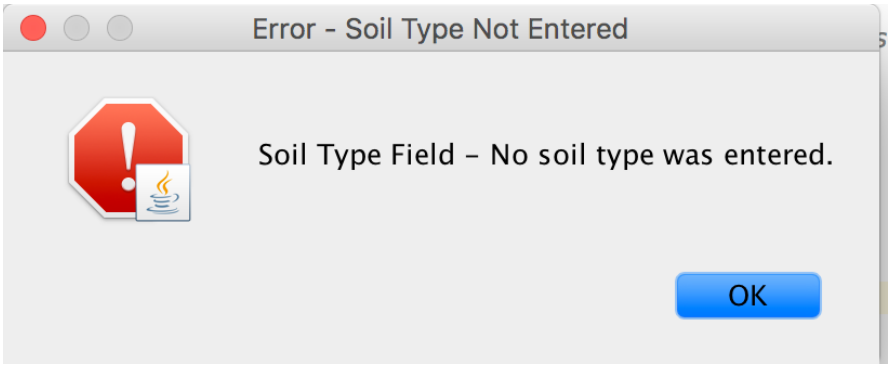


Test Case Results:

Test Case 3 tested on 10/31/17. Test case passed.

Test Case 4: No Soil Type Entered in GUI





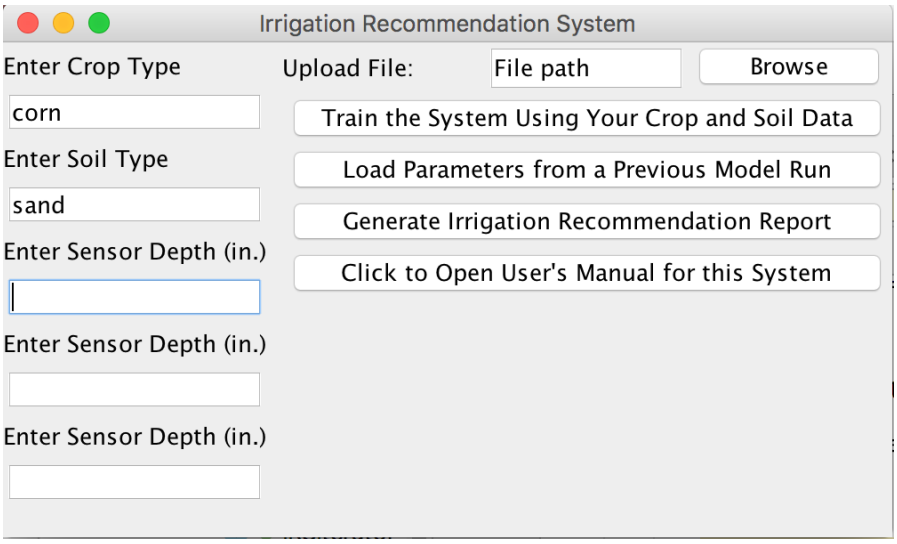
Test Case Results:

Test Case 4 tested on 10/31/17. Test case passed.

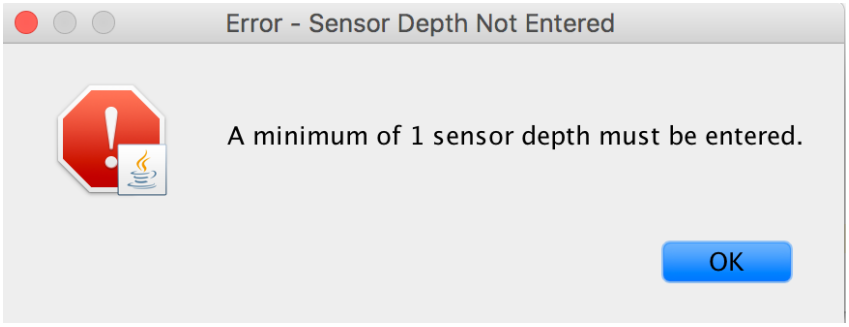
****

- User inputs 1-3 soil moisture sensor depth(s) – minimum of 1 is required and hits enter.

Test Case 5: No SMS depths entered in GUI



Screenshot of GUI with no sensor depths entered.



Error received when train, load, or generate buttons are selected with no sensor depths entered.

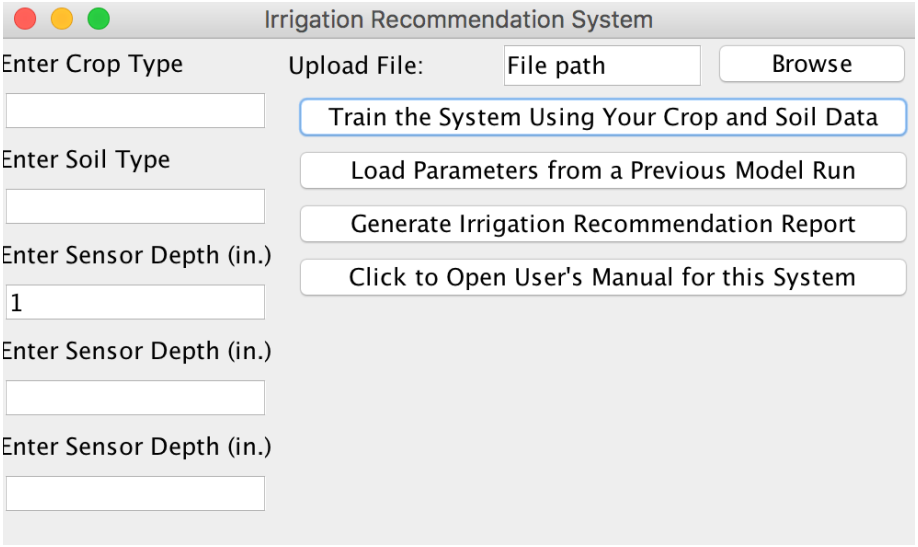
Test Case Results:

Test Case 5 tested on 10/31/17. Test case passed.

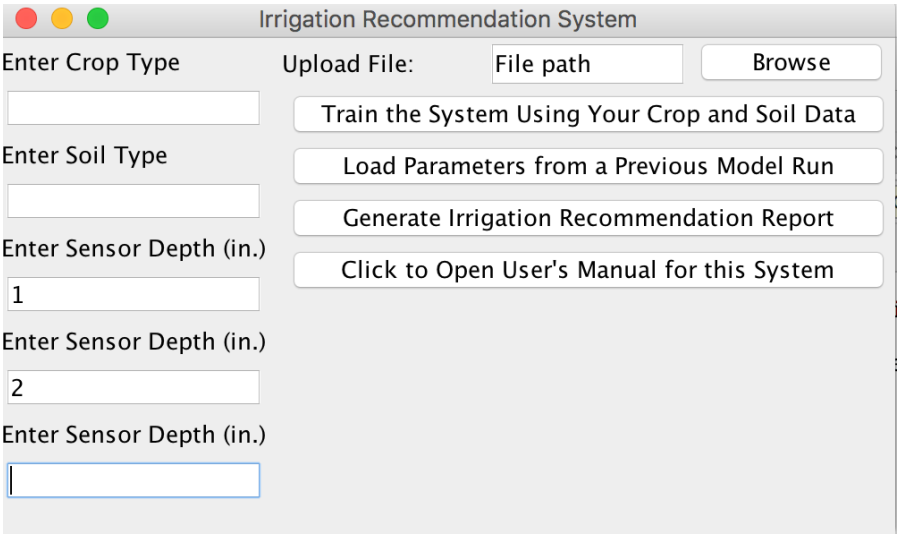
****

Test Case 6: 1-3 SMS depths entered in GUI

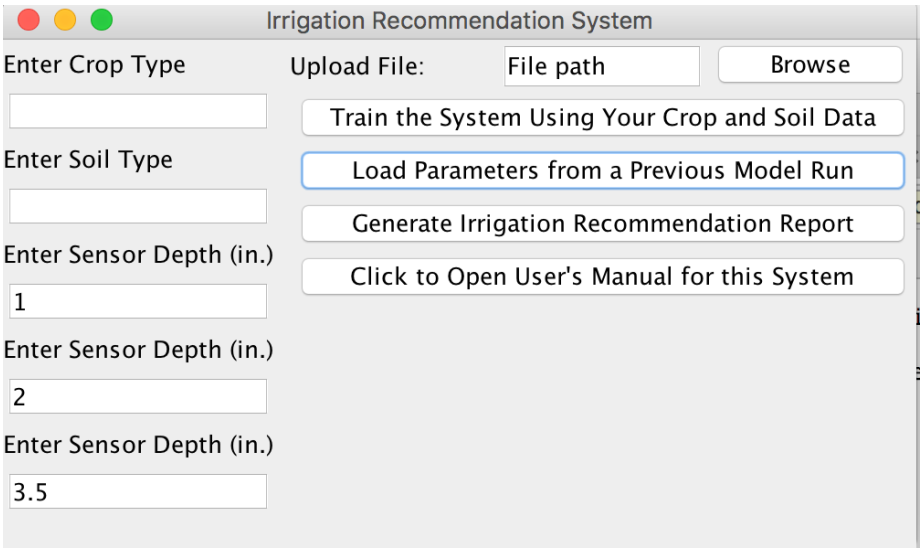
1 sensor depth entered.



2 sensor depths entered.



3 sensor depths entered.



No errors received when train, load, or generate buttons are selected with 1-3 sensor depths entered.

Test Case Results:

Test Case 6 tested on 11/2/17. Test case passed.

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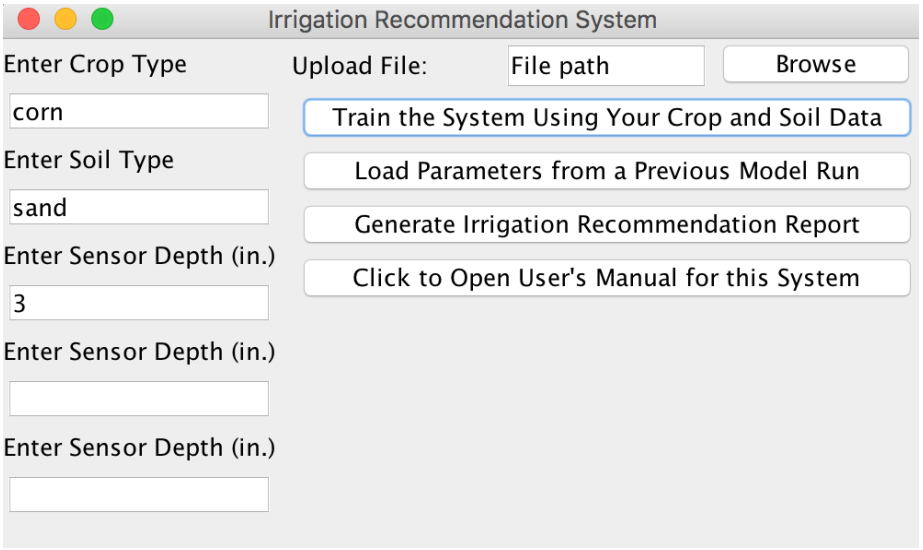
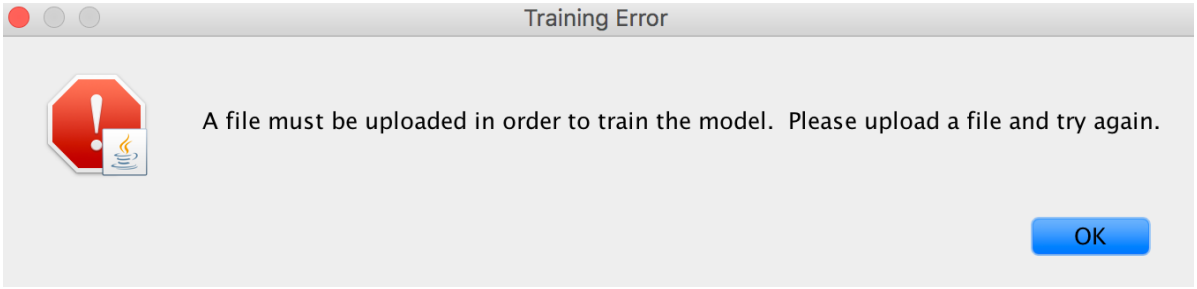
- User uploads file using Upload File field and browse button as outlined in section 6.1.2.

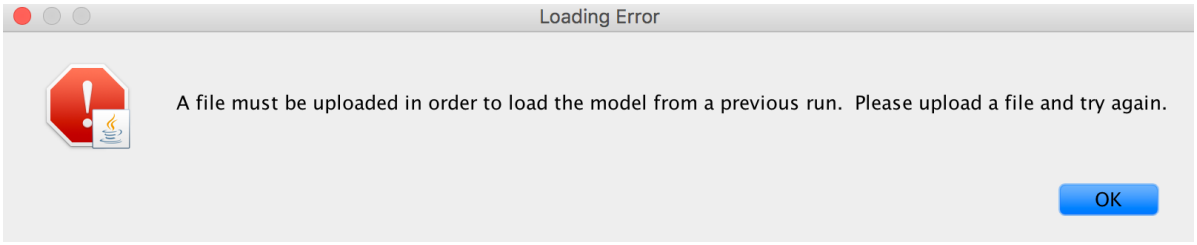
Test Case 7: No file selected in Upload File field



Below is the error produced when the train button is selected and no file has been uploaded:



Below is the error produced when the load button is selected and no file has been uploaded:

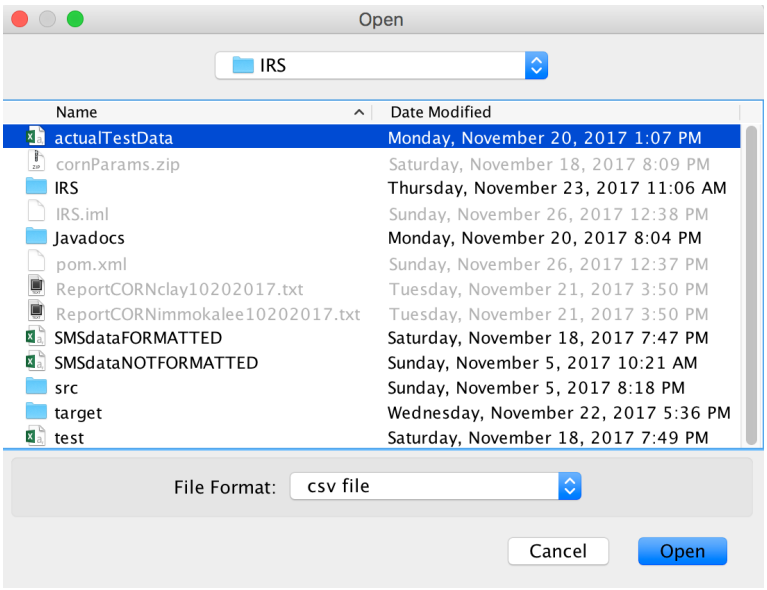


Please note that the crop type, soil type, and a minimum of 1 sensor depth must be entered to receive the 2 errors shown above. Otherwise, the user will be prompted with errors about these missing entries and the above file errors won't occur (i.e., the user must enter the minimum required information before they can train the model).

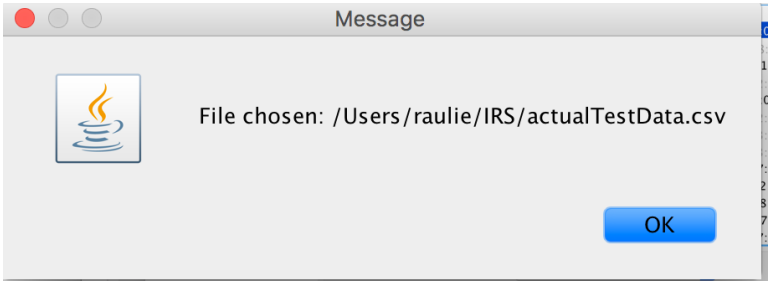
Test Case Results:

Test Case 7 tested on 11/2/17. Test case passed.

Test Case 8: File selected in Upload File field



Below is the message received when a file is properly uploaded.



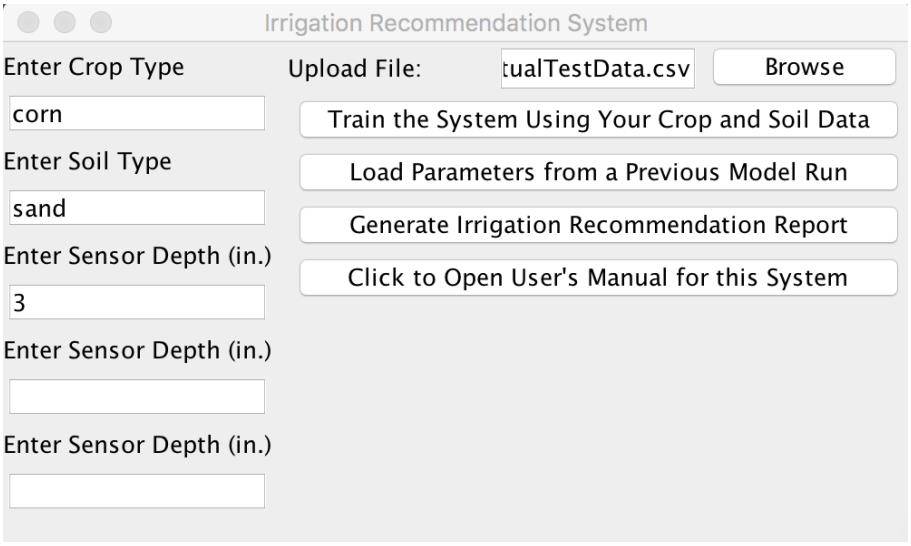
Test Case Results:

Test Case 8 tested on 11/3/17. Test case passed.

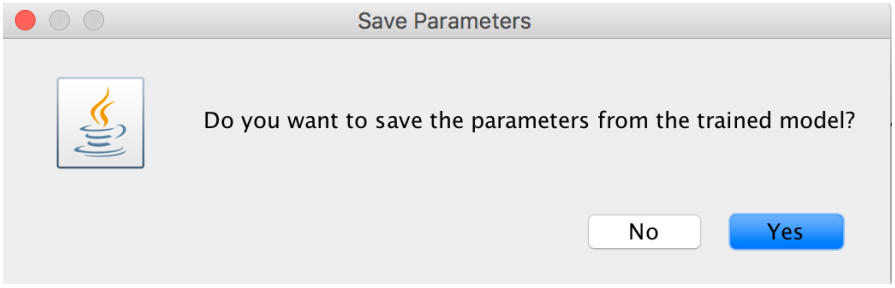
****

- User selects the "Train the System Using Your Crop and Soil Data" button, the "Load Parameters from a Previous Model Run" button, or the "Generate Irrigation Recommendation" button. Please note that each of these systems features are outlined in sections 6.1.3, 6.1.5, and 6.1.6, respectively.

Test Case 9: User Selects the "Train the System Using Your Crop and Soil Data" button

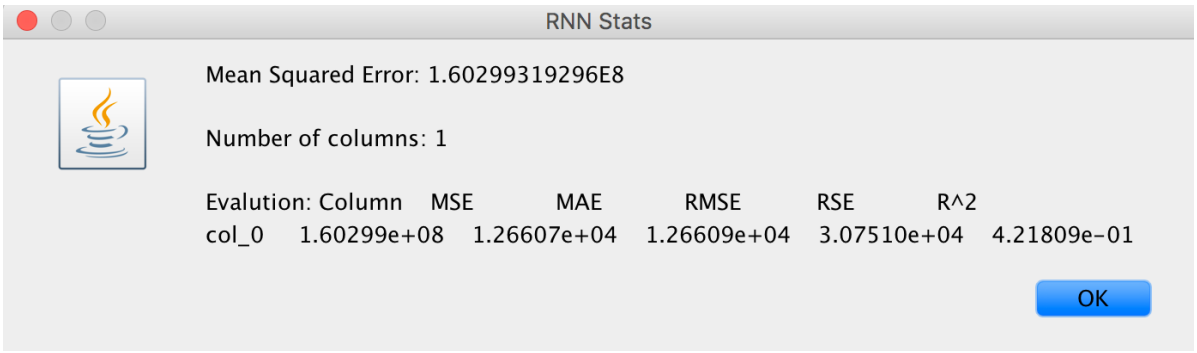


Below is the message received when the crop type, soil type, and a minimum of 1 sensor depth is entered in the GUI and a csv file is uploaded via the Upload File field (and it conforms to the specs laid out in the IRS User's Manual). If all of these elements aren't present, errors will be output by the IRS system (see previous test cases).

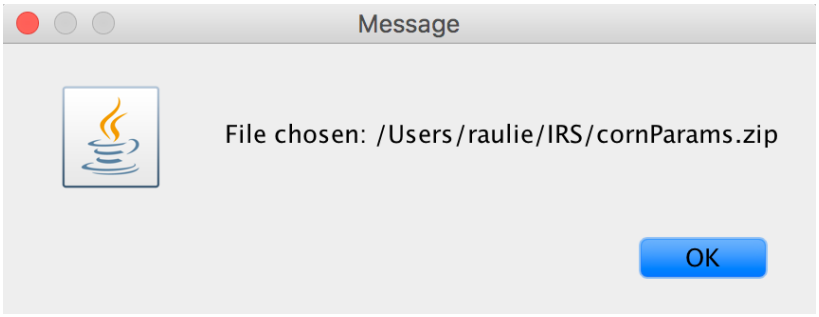


If yes is selected from the Save Parameters message, then the following message is output after the model is trained:

The following message is output after the model is trained regardless of whether the user opted to save the parameters for the model:



Below are the messages received when an incorrect file type (any file type that isn't doesn't have a zip extension) is uploaded and the system attempts to train the RNN/model from an incorrect file. The system will not exit gracefully if the incorrect file type is used to try to train the RNN.

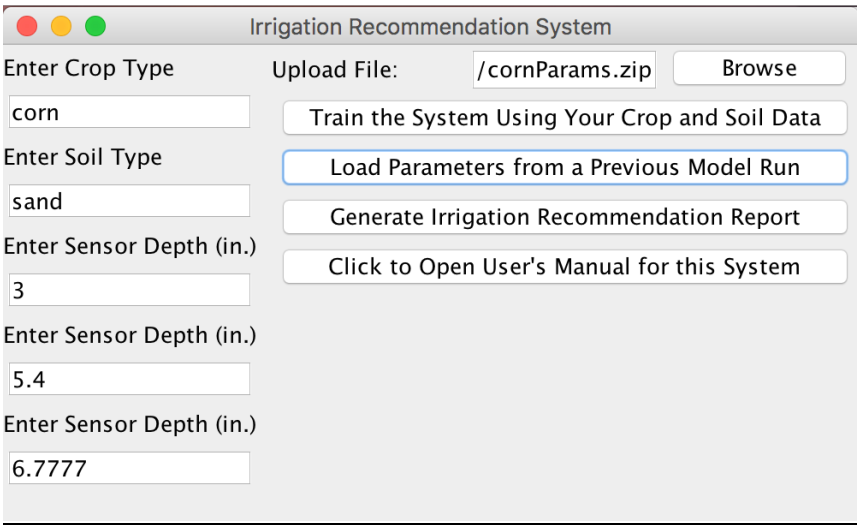


```
Exception in thread "AWT-EventQueue-0" java.lang.IndexOutOfBoundsException: Index: 1, Size: 1
    at java.util.ArrayList.rangeCheck(ArrayList.java:653)
    at java.util.ArrayList.get(ArrayList.java:429)
    at IRSIterator.getNextDataSet(IRSIterator.java:239)
    at IRSIterator.next(IRSIterator.java:197)
    at IRSIterator.next(IRSIterator.java:179)
    at IRSFunctions.runModel(IRSFunctions.java:632)
    at GUI$TrainListener.actionPerformed(GUI.java:521) <4 internal calls>
    at javax.swing.plaf.basic.BasicButtonListener.mouseReleased(BasicButtonListener.java:252) <31 internal calls>
```

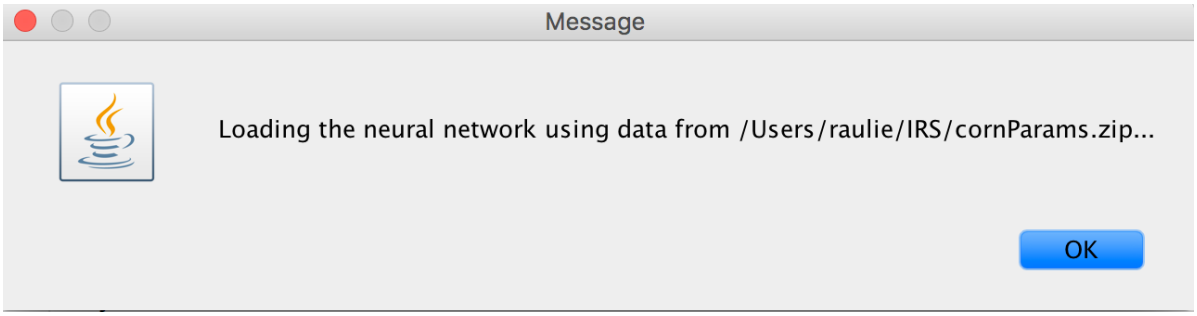
Test Case Results:

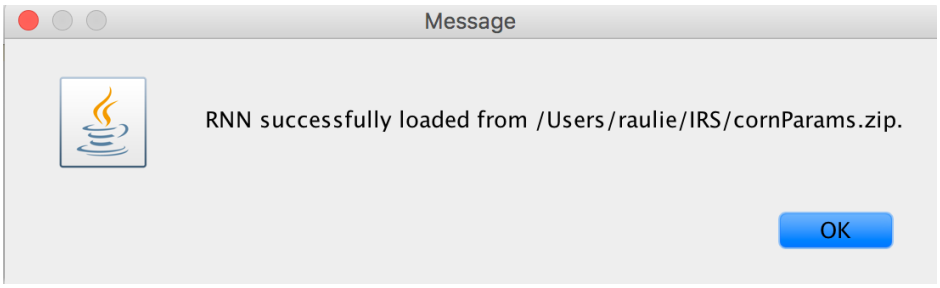
Test Case 9 tested on 11/5/17. Test case passed.

Test Case 10: User Selects the "Load Parameters from a Previous Model Run" button

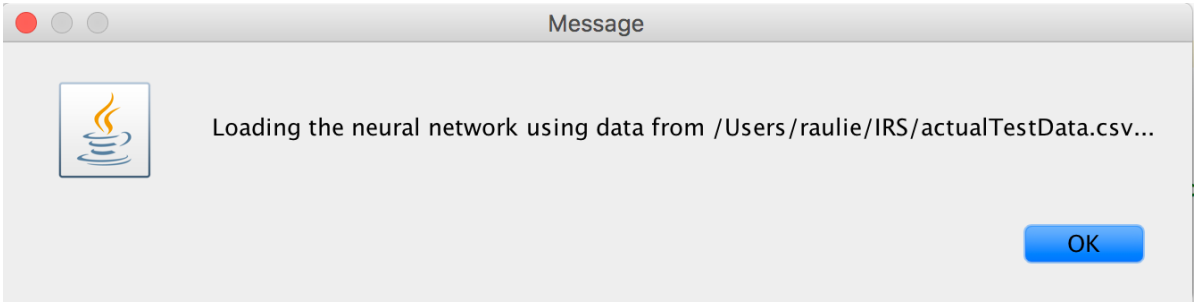


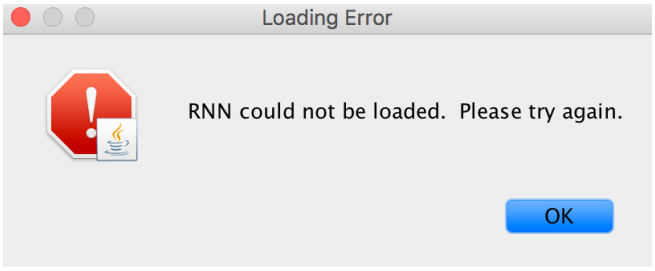
Below is the message received when the crop type, soil type, and a minimum of 1 sensor depth is entered in the GUI and a zip file is uploaded via the Upload File field. If all of these elements aren't present, errors will be output by the IRS system (see previous test cases).





Below are the messages received when an incorrect file type (any file type that isn't doesn't have a zip extension) is uploaded and the system attempts to load the RNN/model from an incorrect file:



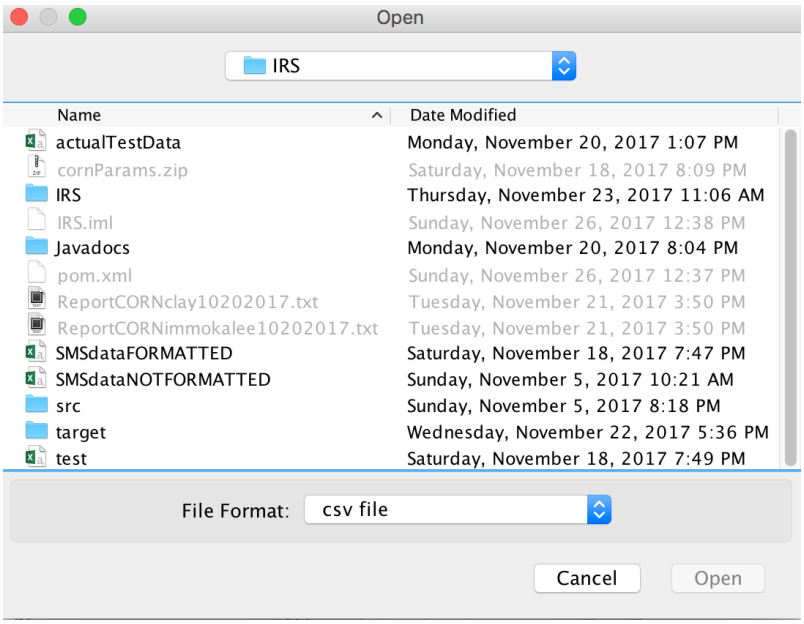


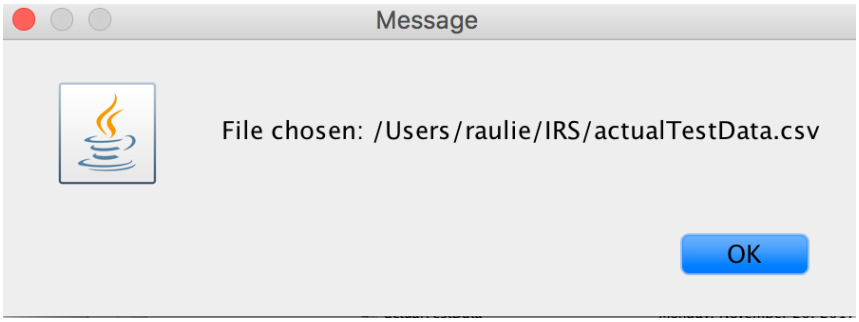
Test Case Results:

Test Case 10 tested on 11/7/17. Test case passed.

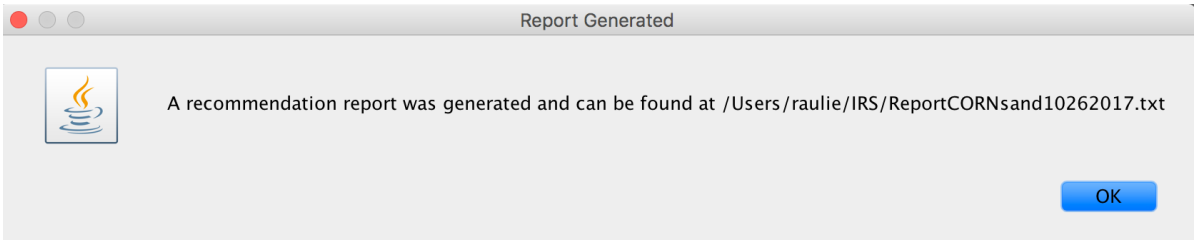
Test Case 11: User Selects the "Generate Irrigation Recommendation Report" button

Below are the screens that are displayed when a user selects the generate button. The system is requesting that the user upload SMS and weather data that the system was not trained on. The data should be in the same format as the training data (i.e., the number of columns should match).

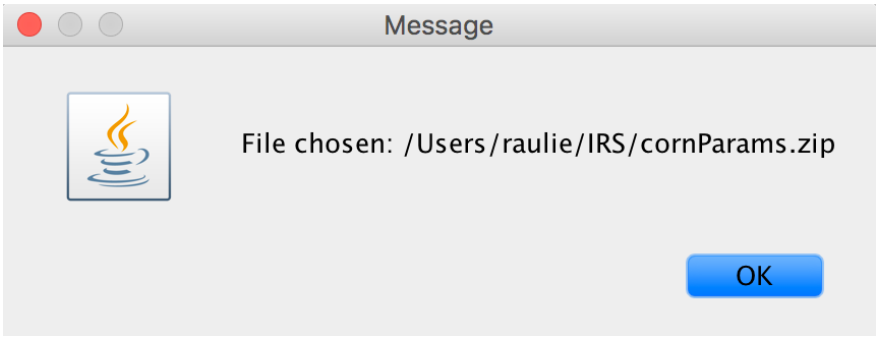




Below is the message received when the crop type, soil type, and a minimum of 1 sensor depth is entered in the GUI. This message also requires that the user has either previously trained the model or loaded the parameters from a previous run. If all of these elements aren't present, errors will be output by the IRS system (see previous test cases).



Below are the messages that are displayed when an incorrect file (a zip file will not work) is chosen to generate a recommendation report:



In this case, the IRS system will exit because of an exception. The system will not exit gracefully if the incorrect file type is used to try to generate an irrigation recommendation report.

```
Exception in thread "AWT-EventQueue-0" java.lang.IndexOutOfBoundsException: Index: 1, Size: 1
    at java.util.ArrayList.rangeCheck(ArrayList.java:653)
    at java.util.ArrayList.get(ArrayList.java:429)
reader was initialized
    at IRSIterator.getNextDataSet(IRSIterator.java:239)
    at IRSIterator.next(IRSIterator.java:197)
    at IRSIterator.next(IRSIterator.java:179)
    at IRSFunctions.generateRecommendation(IRSFunctions.java:702)
    at GUI$GenerateListener.actionPerformed(GUI.java:628) <4 internal calls>
    at javax.swing.plaf.basic.BasicButtonListener.mouseReleased(BasicButtonListener.java:252) <31 internal calls>
```

Test Case Results:

Test Case 11 tested on 11/7/17. Test case passed.

****

6.1.1.2 Functional Requirements

- The system shall allow the user to enter the crop type.
- The system shall allow the user to enter the soil type.
- The system shall allow the user to enter 1-3 soil moisture sensor depths.
- The system shall allow the user to select the “Train the System Using Your Crop and Soil Data” button, the “Load Parameters from a Previous Model Run” button, or the “Generate

Irrigation Recommendation" button (each one of these three system features is outlined below).

All functional requirements are met. Please see test cases 1-11 for details.

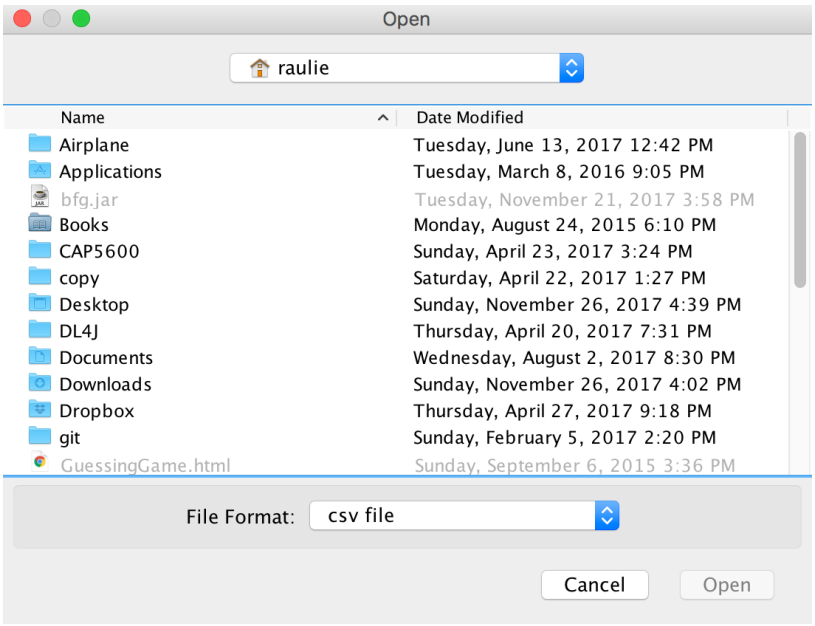
****

6.1.2 System Feature 2 – Upload SMS and Weather Data

6.1.2.1 Stimulus/Response Sequences

- User completes the steps for the Use Case entitled "Enter the Required Data into the GUI" as outlined in section 6.1.1. See test cases in section 6.1.1 for more details.
- User selects the "Browse" button to upload data. See test cases 7 and 8 for details on the functionality of this response.
    - Alternatively, the user can choose to cancel uploading a file which would prevent the system from generating an irrigation recommendation.

Test Case 12: User Selects the Cancel button when Browsing for a File to Upload



Pressing cancel on this screen takes the user back to the GUI.

Test Case Results:

Test Case 12 tested on 11/11/17. Test case passed.

****

- User uploads file using Upload File field and browse button as outlined in section 6.1.2. See test cases 7 and 8 for details on the functionality of this response.
    - User selects the file that they want to upload into the RNN/model. See test cases 7 and 8 for details on the functionality of this response.
    - User is prompted by system when the file is uploaded. See test cases 7 and 8 for details on the functionality of this response.
        - Error will occur if system doesn't recognize the file type or if the file is in an incorrect format. See test cases 9-11 details on the functionality of this response.

6.1.2.2 Functional Requirements

- The system shall allow the user to select the "Browse" button.
- The system shall allow the user to navigate to the file destination of their choice.
- The system shall allow the user to select the file of their choice.
- The system shall allow the user to upload the file chosen.
- The system shall prompt the user when the file they chose has been uploaded.

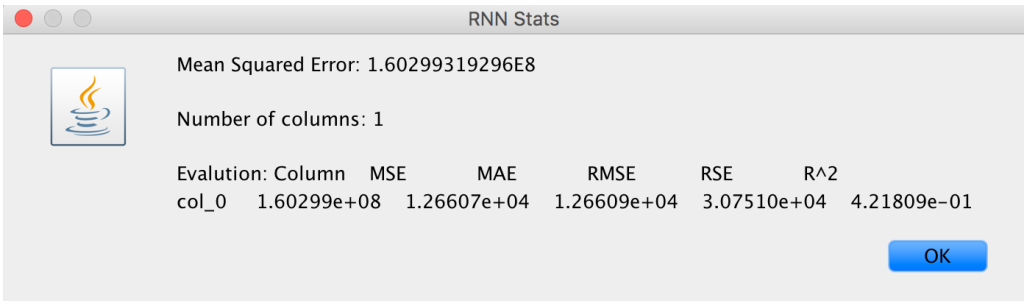
All functional requirements are met. Please see test cases 7-12 for details.

****

6.1.3 System Feature 3 – Train the RNN/Model

6.1.3.1 Stimulus/Response Sequences

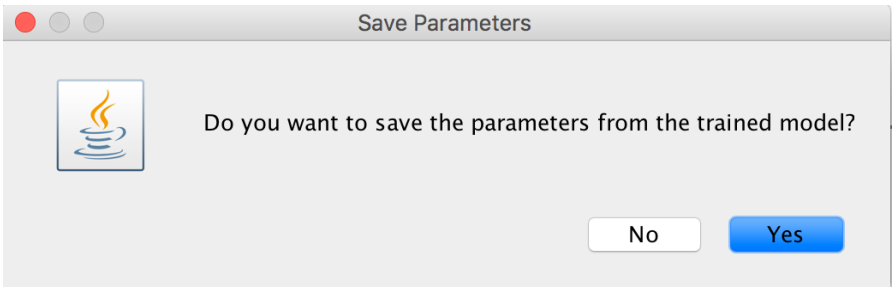
- User completes the steps for the Use Case entitled "Enter the Required Data into the GUI" as outlined in section 6.1.1. See test cases in section 6.1.1 for more details.
- User completes the steps for the Use Case entitled "Upload SMS and Weather Data" as outlined in section 6.1.2. See test cases in section 6.1.2 for more details.
- User selects the "Train the System Using Your Crop and Soil Data" button. See test case 9 for details on the functionality of this response.
    - Error will occur if the user doesn't enter the crop type, soil type, upload a file, and/or enter a minimum of 1 soil moisture sensor depth. See test cases 2, 4, 5, and 7 for the crop type, soil type, minimum of 1 SMS depth, and file upload errors.
- User is prompted by system when training is finished. See test case 9 for details on the functionality of this response. More specifically, the user will be prompted with the RNN stats message, shown below, when the model is done being trained.



- If the user opts to save the model parameters, the system shall save the RNN's parameters to a file destination set by the system. See test case 9 for details on the functionality of this response. More specifically, the user will be prompted with the File Saved message, shown

below, when the model parameters are trained. This message will indicate where the parameters have been saved.

- User can also opt to discard model parameters. See test case 9 for details on the functionality of this response. The user will be prompted with the Save Parameters option, shown below, before the model is trained. The choice selected will determine whether the system needs to save the parameters from the model run. The name of the file will be a concatenation of the crop type and the "Params.zip" and will be saved in the user's current working directory. If a file with this name already exists, it will be overwritten.



6.1.3.2 Functional Requirements

- The system shall allow the user to upload training data.
- The system shall allow the user to select the "Train the System Using Your Crop and Soil Data" button.

- The system shall prompt the user when the RNN/model has finished optimizing/tuning its parameters based on the number of epochs and iterations that are chosen (note: the system administrator and project manager will determine the learning rate, number of epochs, and number of iterations to be used in optimizing the RNN/model later in the project).
- The system shall save the RNN's parameters to a file destination and name as outlined in section 6.1.4.1.

All functional requirements are met. Please see test cases 2, 4, 5, 7, and 9 for details.

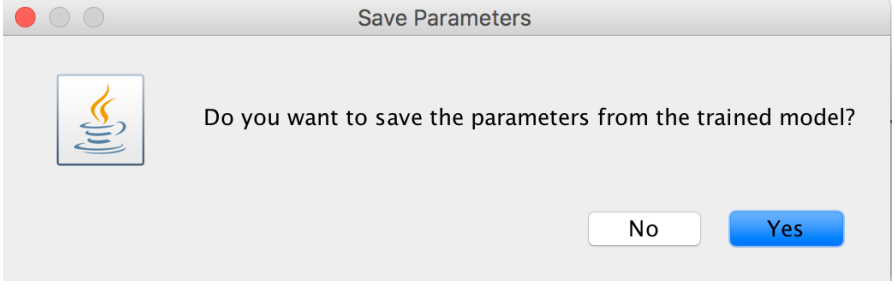
****

6.1.4 System Feature 4 – Save the RNN/Model Parameters

6.1.4.1 Stimulus/Response Sequences

- User completes the steps for the Use Case entitled "Enter the Required Data into the GUI" as outlined in section 6.1.1. See test cases in section 6.1.1 for more details.
- User completes the steps for the Use Case entitled "Upload SMS and Weather Data" as outlined in section 6.1.2. See test cases in section 6.1.2 for more details.
- User completes the steps for the Use Case entitled "Train the RNN/model" as outlined in section 6.1.3. See test cases in section 6.1.3 for more details.
- User selects the "Save Parameters from a Model Run" button to save the model's parameters generated by the training run.
    - Alternatively, the user can choose to cancel saving the parameters. See test case 9 for details on the functionality of this response. The user will be prompted with the Save Parameters option, shown below, before the model is trained. The choice selected will determine whether the system needs to save the parameters from the model run. The name of the file will be a concatenation of the crop type and the

"Params.zip" and will be saved in the user's current working directory. If a file with this name already exists, it will be overwritten.



- System generates the destination/file path for saving the parameters from the RNN/model training run. See test case 9 for details on the functionality of this response. The name of the file will be a concatenation of the crop type and the "Params.zip" and will be saved in the user's current working directory.
- User is prompted by system when and where the file is saved. See test case 9 for details on the functionality of this response. More specifically, the user will be prompted with the File Saved message, shown below, when the model parameters are trained. This message will indicate where the parameters have been saved.

6.1.4.2 Functional Requirements

- The system shall allow the user to select the "Save Parameters from a Model Run" button.
- The system shall designate the file name and path of the saved parameters.
- The system shall allow the user the choice to save the file.

- The system shall prompt the user when and where the file they chose has been saved.

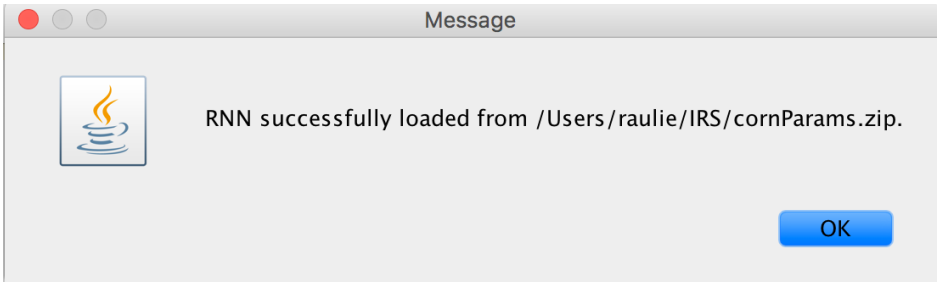
All functional requirements are met. Please see test cases 2, 4, 5, 7, and 9 for details.

****

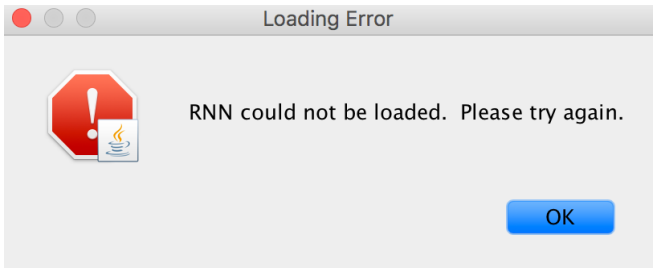
6.1.5 System Feature 5 – Load Parameters from Previous RNN/Model Run

6.1.5.1 Stimulus/Response Sequences

- User completes the steps for the Use Case entitled "Enter the Required Data into the GUI" as outlined in section 6.1.1. See test cases in section 6.1.1 for more details.
- User completes the steps for the Use Case entitled "Upload SMS and Weather Data" as outlined in section 6.1.2. See test cases in section 6.1.2 for more details.
- User selects the "Load Parameters from a Previous Model Run" button. See test case 10 for details on the functionality of this response.
- User is prompted by system when parameters are loaded. See test case 10 for details on the functionality of this response. The user will be prompted with the message below when the system successfully loads the model from file.



  - Error will occur if system doesn't recognize or validate parameters. See test case 10 for details on the functionality of this response. The user will see the error below if the file chosen doesn't contain model parameters and/or it is not the correct file type.



6.1.5.2 Functional Requirements

- The system shall allow the user to upload a file with parameters saved from a previous model run.
- The system shall allow the user to select the "Load Parameters from a Previous Model Run" button.
- The system shall prompt the user when the RNN's parameter are loaded from the file that was selected.

All functional requirements are met. Please see test case 10 for details.

****

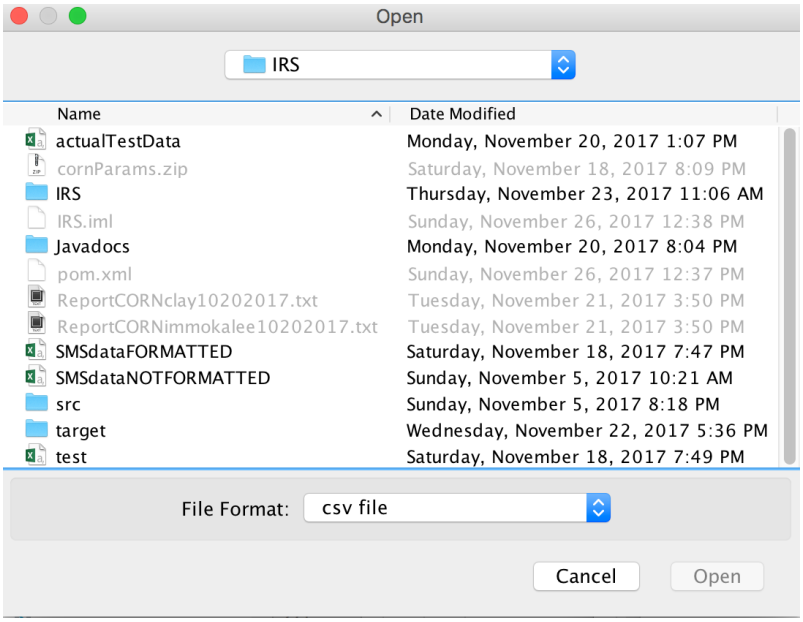
6.1.6 System Feature 6 – Generate Irrigation Recommendation Report

6.1.6.1 Stimulus/Response Sequences

- User completes the steps for the Use Case entitled "Enter the Required Data into the GUI" as outlined in section 6.1.1. See test cases in section 6.1.1 for more details.
- User completes the steps for the Use Case entitled "Upload SMS and Weather Data" as outlined in section 6.1.2. See test cases in section 6.1.2 for more details.
- User completes the steps for the Use Case entitled "Train the RNN/model" as outlined in section 6.1.3 or the steps for the Use Case entitled "Load Parameters from Previous RNN/model Run" as outlined in section 6.1.5. See test cases in section 6.1.3 or 6.1.5,

depending on whether the model was trained or the parameters were loaded from a previous run, for more details.

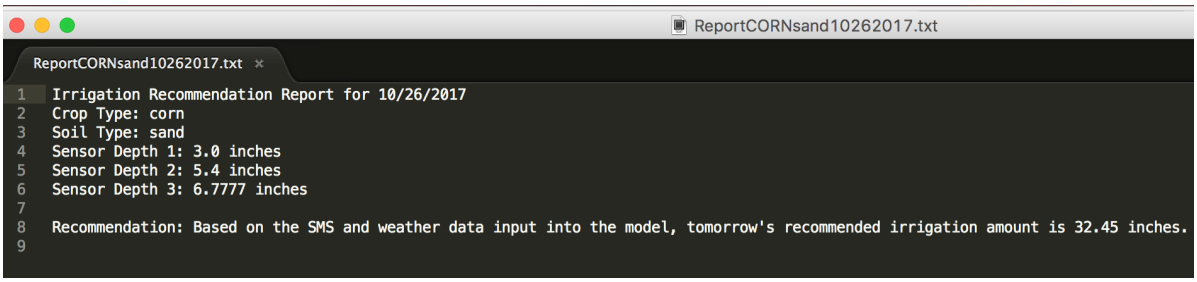
- User selects the "Generate Irrigation Recommendation" button. See test case 11 for details on the functionality of this response.
    - User can cancel producing an irrigation recommendation report. See open dialog box below.



- System will generate an irrigation recommendation report and open the report for the user to view.

Test Case 13: System Generates Report and Displays it on the Screen

Below is a screenshot of the txt file that is opened once the system generates an irrigation recommendation report.



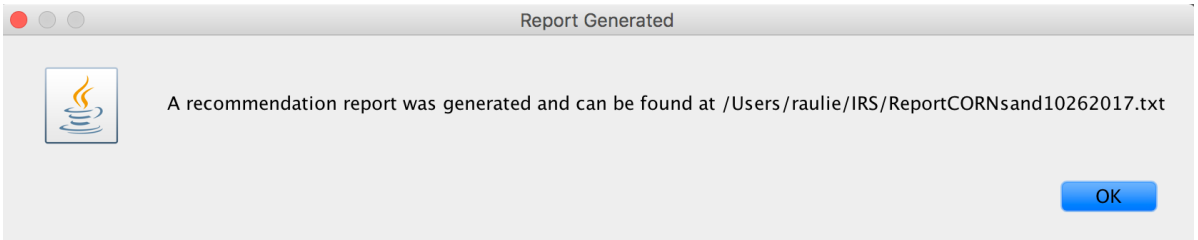
The file path will be set to the current working directory and the file name will be a concatenation of "Report" + crop type (in uppercase) + soil type (in lowercase) + month + day + year + ".txt". Please note that the month, day, and year will be generated by the system calendar.

Test Case Results:

Test Case 13 tested on 11/18/17. Test case passed.

****

- System will prompt user with a message displaying the file path and file name for the report. See test case 11 for details on the functionality of this response. See the report generated message below.



6.1.6.2 Functional Requirements

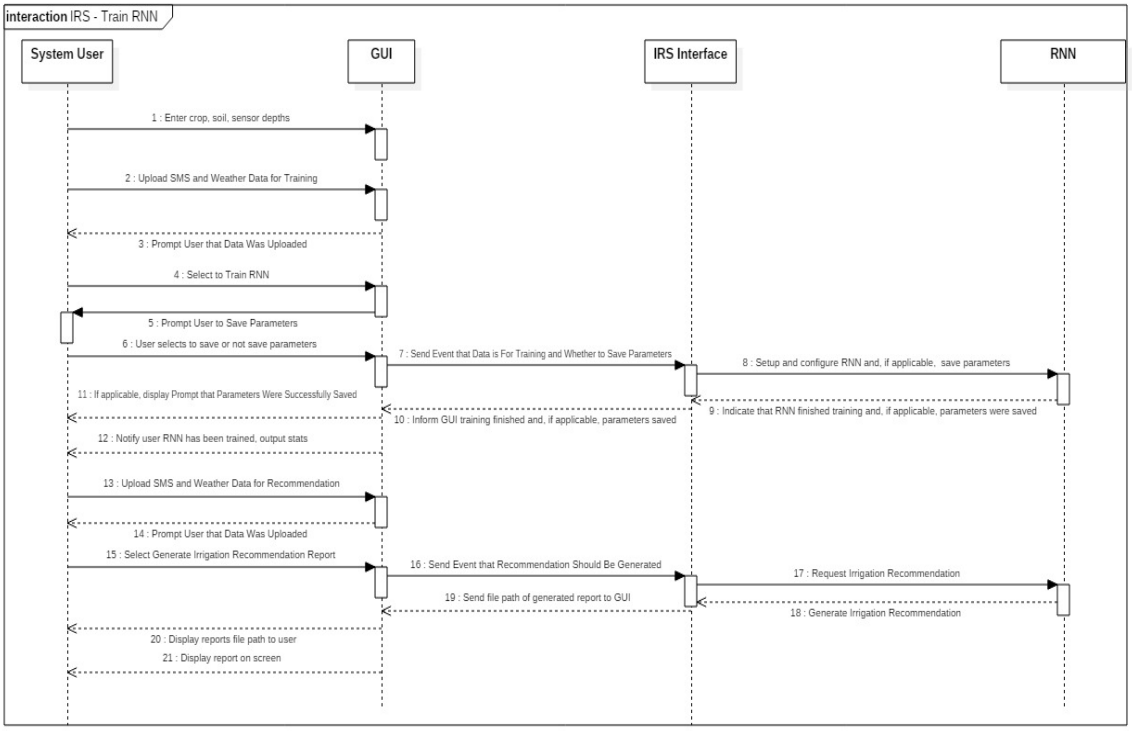
- The system shall allow the user to select the "Generate Irrigation Recommendation" button.
- The system shall prompt the user that the report was generated.
- The system shall display the report on screen.
- The system shall inform the user where the report was saved.

All functional requirements are met. Please see test cases 11 and 13 for details.

****

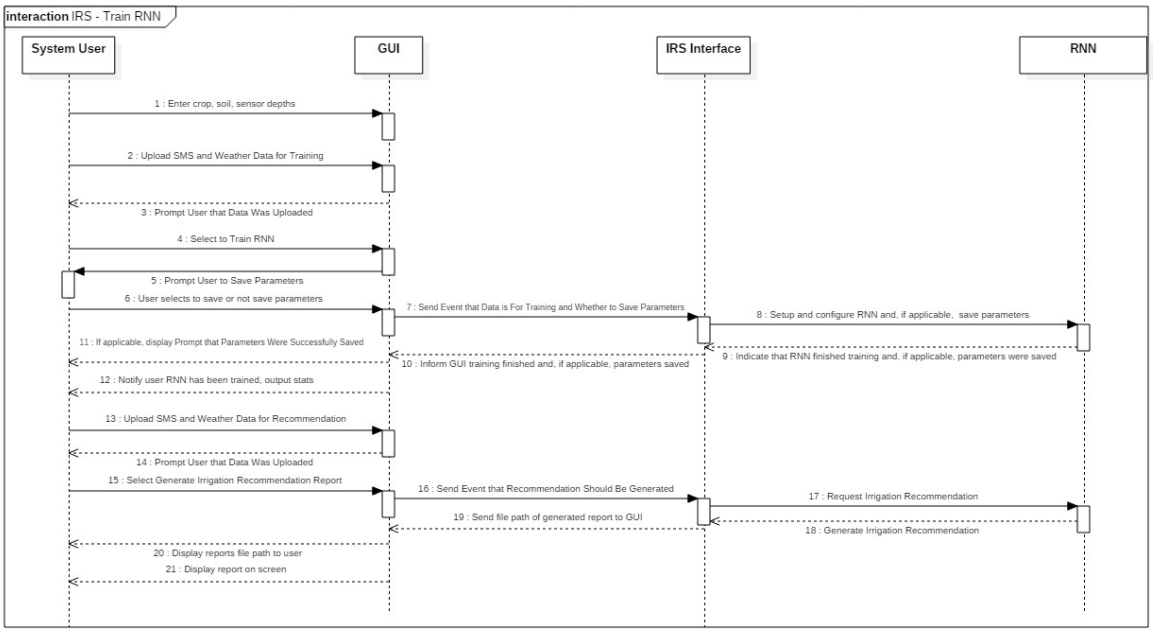
7 FUNCTIONAL TESTING

7.1.1 Train RNN Sequence Diagram



The functionality for the train RNN sequence conforms to the functionality tested in sections 6.1.1 through 6.1.6 (excluding section 6.1.5). The functionality in these sections follows the sequence identified in this diagram.

7.1.2 Load RNN Sequence Diagram



The functionality for the load RNN sequence conforms to the functionality tested in sections 6.1.1, 6.1.2, 6.1.5, and 6.1.6. The functionality in these sections follows the sequence identified in this diagram.

8 DEPLOYMENT TESTING

8.1 DEPLOYMENT ON MAC OSX

The following message is output when packaging the IRS product into a shaded jar:

```
/Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java -
Dmaven.multiModuleProjectDirectory=/Users/raulie/IRS "-Dmaven.home=/Applications/IntelliJ IDEA
CE.app/Contents/plugins/maven/lib/maven3" "-Dclassworlds.conf=/Applications/IntelliJ IDEA
CE.app/Contents/plugins/maven/lib/maven3/bin/m2.conf" -Didea.launcher.port=7537 "-
Didea.launcher.bin.path=/Applications/IntelliJ IDEA CE.app/Contents/bin" -Dfile.encoding=UTF-8 -classpath
"/Applications/IntelliJ IDEA CE.app/Contents/plugins/maven/lib/maven3/boot/plexus-classworlds-
2.5.2.jar:/Applications/IntelliJ IDEA CE.app/Contents/lib/idea_rt.jar"
com.intellij.rt.execution.application.AppMain org.codehaus.classworlds.Launcher -Didea.version=2016.3.6
package
[INFO] Scanning for projects...
[INFO]
```

```
[INFO] ------------------------------------------------------------------------
[INFO] Building IRS 1.1
[INFO] ------------------------------------------------------------------------
[INFO]
[INFO] --- maven-enforcer-plugin:1.4.1:enforce (enforce-default) @ irrigation-recommendation-system ---
[INFO]
[INFO] --- maven-resources-plugin:2.6:resources (default-resources) @ irrigation-recommendation-system ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] Copying 0 resource
[INFO]
[INFO] --- maven-compiler-plugin:3.6.1:compile (default-compile) @ irrigation-recommendation-system ---
[INFO] Nothing to compile - all classes are up to date
[INFO]
[INFO] --- maven-resources-plugin:2.6:testResources (default-testResources) @ irrigation-recommendation-
system ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /Users/raulie/IRS/src/test/resources
[INFO]
[INFO] --- maven-compiler-plugin:3.6.1:testCompile (default-testCompile) @ irrigation-recommendation-
system ---
[INFO] Nothing to compile - all classes are up to date
[INFO]
[INFO] --- maven-surefire-plugin:2.12.4:test (default-test) @ irrigation-recommendation-system ---
[INFO] No tests to run.
[INFO]
[INFO] --- maven-jar-plugin:3.0.2:jar (default-jar) @ irrigation-recommendation-system ---
[INFO] Building jar: /Users/raulie/IRS/target/irrigation-recommendation-system-1.1.jar
[INFO]
[INFO] --- maven-shade-plugin:2.4.3:shade (default) @ irrigation-recommendation-system ---
[INFO] Including org.nd4j:nd4j-native-platform:jar:0.9.1 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas-platform:jar:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:android-arm:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:android-x86:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:linux-x86:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:linux-x86_64:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:linux-armhf:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:linux-ppc64le:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:macosx-x86_64:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:windows-x86:0.2.19-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:openblas:jar:windows-x86_64:0.2.19-1.3 in the shaded jar.
[INFO] Including org.nd4j:nd4j-native:jar:0.9.1 in the shaded jar.
[INFO] Including org.bytedeco:javacpp:jar:1.3.3 in the shaded jar.
[INFO] Including org.nd4j:nd4j-native:jar:android-arm:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-native:jar:android-x86:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-native:jar:linux-x86_64:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-native:jar:macosx-x86_64:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-native:jar:windows-x86_64:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-native:jar:linux-ppc64le:0.9.1 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-core:jar:0.9.1 in the shaded jar.
[INFO] Including org.deeplearning4j:nearestneighbor-core:jar:0.9.1 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-modelimport:jar:0.9.1 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:hdf5-platform:jar:1.10.0-patch1-1.3 in the shaded jar.
```

[INFO] Including org.bytedeco.javacpp-presets:hdf5:jar:1.10.0-patch1-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:hdf5:jar:linux-x86:1.10.0-patch1-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:hdf5:jar:linux-x86_64:1.10.0-patch1-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:hdf5:jar:linux-ppc64le:1.10.0-patch1-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:hdf5:jar:macosx-x86_64:1.10.0-patch1-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:hdf5:jar:windows-x86:1.10.0-patch1-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:hdf5:jar:windows-x86_64:1.10.0-patch1-1.3 in the shaded jar.
[INFO] Including org.slf4j:slf4j-api:jar:1.7.12 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-nn:jar:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-common:jar:0.9.1 in the shaded jar.
[INFO] Including com.github.stephenc.findbugs:findbugs-annotations:jar:1.3.9-1 in the shaded jar.
[INFO] Including org.apache.commons:commons-math3:jar:3.4.1 in the shaded jar.
[INFO] Including commons-io:commons-io:jar:2.4 in the shaded jar.
[INFO] Including org.apache.commons:commons-compress:jar:1.8 in the shaded jar.
[INFO] Including org.tukaani:xz:jar:1.5 in the shaded jar.
[INFO] Including org.nd4j:nd4j-api:jar:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-buffer:jar:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-context:jar:0.9.1 in the shaded jar.
[INFO] Including net.ericaro:neoitertools:jar:1.0.0 in the shaded jar.
[INFO] Including junit:junit:jar:4.8.2 in the shaded jar.
[INFO] Including org.reflections:reflections:jar:0.9.10 in the shaded jar.
[INFO] Including org.javassist:javassist:jar:3.19.0-GA in the shaded jar.
[INFO] Including com.google.code.findbugs:annotations:jar:2.0.1 in the shaded jar.
[INFO] Including org.apache.commons:commons-lang3:jar:3.4 in the shaded jar.
[INFO] Including org.nd4j:jackson:jar:0.9.1 in the shaded jar.
[INFO] Including org.yaml:snakeyaml:jar:1.12 in the shaded jar.
[INFO] Including org.codehaus.woodstox:stax2-api:jar:3.1.4 in the shaded jar.
[INFO] Including joda-time:joda-time:jar:2.2 in the shaded jar.
[INFO] Including org.projectlombok:lombok:jar:1.16.16 in the shaded jar.
[INFO] Including org.datavec:datavec-api:jar:0.9.1 in the shaded jar.
[INFO] Including org.freemarker:freemarker:jar:2.3.23 in the shaded jar.
[INFO] Including com.clearspring.analytics:stream:jar:2.7.0 in the shaded jar.
[INFO] Including it.unimi.dsi:fastutil:jar:6.5.7 in the shaded jar.
[INFO] Including net.sf.opencsv:opencsv:jar:2.3 in the shaded jar.
[INFO] Including org.datavec:datavec-data-image:jar:0.9.1 in the shaded jar.
[INFO] Including com.github.jai-imageio:jai-imageio-core:jar:1.3.0 in the shaded jar.
[INFO] Including com.twelvemonkeys.imageio:imageio-jpeg:jar:3.1.1 in the shaded jar.
[INFO] Including com.twelvemonkeys.imageio:imageio-core:jar:3.1.1 in the shaded jar.
[INFO] Including com.twelvemonkeys.imageio:imageio-metadata:jar:3.1.1 in the shaded jar.
[INFO] Including com.twelvemonkeys.common:common-lang:jar:3.1.1 in the shaded jar.
[INFO] Including com.twelvemonkeys.common:common-io:jar:3.1.1 in the shaded jar.
[INFO] Including com.twelvemonkeys.common:common-image:jar:3.1.1 in the shaded jar.
[INFO] Including com.twelvemonkeys.imageio:imageio-tiff:jar:3.1.1 in the shaded jar.
[INFO] Including com.twelvemonkeys.imageio:imageio-psd:jar:3.1.1 in the shaded jar.
[INFO] Including com.twelvemonkeys.imageio:imageio-bmp:jar:3.1.1 in the shaded jar.
[INFO] Including org.bytedeco:javacv:jar:1.3.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:ffmpeg:jar:3.2.1-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:flycapture:jar:2.9.3.43-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:libdc1394:jar:2.2.4-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:libfreenect:jar:0.5.3-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:libfreenect2:jar:0.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:librealsense:jar:1.9.6-1.3 in the shaded jar.

[INFO] Including org.bytedeco.javacpp-presets:videoinput:jar:0.200-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:artoolkitplus:jar:2.3.1-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:flandmark:jar:1.07-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv-platform:jar:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:android-arm:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:android-x86:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:linux-x86:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:linux-x86_64:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:linux-armhf:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:linux-ppc64le:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:macosx-x86_64:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:windows-x86:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:opencv:jar:windows-x86_64:3.2.0-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica-platform:jar:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:android-arm:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:android-x86:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:linux-x86:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:linux-x86_64:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:linux-armhf:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:linux-ppc64le:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:macosx-x86_64:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:windows-x86:1.73-1.3 in the shaded jar.
[INFO] Including org.bytedeco.javacpp-presets:leptonica:jar:windows-x86_64:1.73-1.3 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-ui-components:jar:0.9.1 in the shaded jar.
[INFO] Including commons-codec:commons-codec:jar:1.10 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-nlp:jar:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-native-api:jar:0.9.1 in the shaded jar.
[INFO] Including commons-lang:commons-lang:jar:2.6 in the shaded jar.
[INFO] Including org.nd4j:nd4j-jackson:jar:0.9.1 in the shaded jar.
[INFO] Including org.nd4j:nd4j-base64:jar:0.9.1 in the shaded jar.
[INFO] Including commons-net:commons-net:jar:3.1 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-ui_2.10:jar:0.9.1 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-play_2.10:jar:0.9.1 in the shaded jar.
[INFO] Including com.typesafe.play:play-java_2.10:jar:2.4.6 in the shaded jar.
[INFO] Including org.scala-lang:scala-library:jar:2.10.5 in the shaded jar.
[INFO] Including com.typesafe.play:play_2.10:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe.play:build-link:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe.play:play-exceptions:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe.play:play-iteratees_2.10:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe:config:jar:1.3.0 in the shaded jar.
[INFO] Including com.typesafe.play:play-json_2.10:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe.play:play-functional_2.10:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe.play:play-datacommons_2.10:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe.play:play-netty-utils:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe.play:twirl-api_2.10:jar:1.1.1 in the shaded jar.
[INFO] Including org.slf4j:jul-to-slf4j:jar:1.7.12 in the shaded jar.
[INFO] Including org.slf4j:jcl-over-slf4j:jar:1.7.12 in the shaded jar.
[INFO] Including ch.qos.logback:logback-core:jar:1.2.3 in the shaded jar.
[INFO] Including ch.qos.logback:logback-classic:jar:1.1.7 in the shaded jar.
[INFO] Including com.typesafe.akka:akka-actor_2.10:jar:2.3.13 in the shaded jar.
[INFO] Including com.typesafe.akka:akka-slf4j_2.10:jar:2.3.13 in the shaded jar.
[INFO] Including org.scala-stm:scala-stm_2.10:jar:0.7 in the shaded jar.

[INFO] Including org.joda:joda-convert:jar:1.7 in the shaded jar.
[INFO] Including xerces:xercesImpl:jar:2.11.0 in the shaded jar.
[INFO] Including xml-apis:xml-apis:jar:1.4.01 in the shaded jar.
[INFO] Including javax.transaction:jta:jar:1.1 in the shaded jar.
[INFO] Including com.google.inject:guice:jar:4.0 in the shaded jar.
[INFO] Including javax.inject:javax.inject:jar:1 in the shaded jar.
[INFO] Including aopalliance:aopalliance:jar:1.0 in the shaded jar.
[INFO] Including com.google.inject.extensions:guice-assistedinject:jar:4.0 in the shaded jar.
[INFO] Including org.scala-lang.modules:scala-java8-compat_2.10:jar:0.3.0 in the shaded jar.
[INFO] Including org.hibernate:hibernate-validator:jar:5.0.3.Final in the shaded jar.
[INFO] Including javax.validation:validation-api:jar:1.1.0.Final in the shaded jar.
[INFO] Including com.fasterxml:classmate:jar:1.0.0 in the shaded jar.
[INFO] Including org.jboss.logging:jboss-logging:jar:3.2.1.Final in the shaded jar.
[INFO] Including org.springframework:spring-context:jar:4.1.6.RELEASE in the shaded jar.
[INFO] Including org.springframework:spring-core:jar:4.1.6.RELEASE in the shaded jar.
[INFO] Including org.springframework:spring-beans:jar:4.1.6.RELEASE in the shaded jar.
[INFO] Including net.jodah:typetools:jar:0.4.3 in the shaded jar.
[INFO] Including org.apache.tomcat:tomcat-servlet-api:jar:8.0.21 in the shaded jar.
[INFO] Including com.typesafe.play:play-netty-server_2.10:jar:2.4.6 in the shaded jar.
[INFO] Including com.typesafe.play:play-server_2.10:jar:2.4.6 in the shaded jar.
[INFO] Including io.netty:netty:jar:3.10.4.Final in the shaded jar.
[INFO] Including com.typesafe.netty:netty-http-pipelining:jar:1.1.4 in the shaded jar.
[INFO] Including com.typesafe.akka:akka-contrib_2.10:jar:2.3.13 in the shaded jar.
[INFO] Including com.typesafe.akka:akka-remote_2.10:jar:2.3.13 in the shaded jar.
[INFO] Including com.google.protobuf:protobuf-java:jar:2.5.0 in the shaded jar.
[INFO] Including org.uncommons.maths:uncommons-maths:jar:1.2.2a in the shaded jar.
[INFO] Including com.typesafe.akka:akka-persistence-experimental_2.10:jar:2.3.13 in the shaded jar.
[INFO] Including org.iq80.leveldb:leveldb:jar:0.5 in the shaded jar.
[INFO] Including org.iq80.leveldb:leveldb-api:jar:0.5 in the shaded jar.
[INFO] Including org.fusesource.leveldbjni:leveldbjni-all:jar:1.7 in the shaded jar.
[INFO] Including org.fusesource.leveldbjni:leveldbjni:jar:1.7 in the shaded jar.
[INFO] Including org.fusesource.hawtjni:hawtjni-runtime:jar:1.8 in the shaded jar.
[INFO] Including org.fusesource.leveldbjni:leveldbjni-osx:jar:1.5 in the shaded jar.
[INFO] Including org.fusesource.leveldbjni:leveldbjni-linux32:jar:1.5 in the shaded jar.
[INFO] Including org.fusesource.leveldbjni:leveldbjni-linux64:jar:1.5 in the shaded jar.
[INFO] Including org.fusesource.leveldbjni:leveldbjni-win32:jar:1.5 in the shaded jar.
[INFO] Including org.fusesource.leveldbjni:leveldbjni-win64:jar:1.5 in the shaded jar.
[INFO] Including com.fasterxml.jackson.core:jackson-core:jar:2.4.4 in the shaded jar.
[INFO] Including com.fasterxml.jackson.core:jackson-databind:jar:2.4.4 in the shaded jar.
[INFO] Including com.fasterxml.jackson.core:jackson-annotations:jar:2.4.4 in the shaded jar.
[INFO] Including com.fasterxml.jackson.module:jackson-module-scala_2.10:jar:2.4.4 in the shaded jar.
[INFO] Including org.scala-lang:scala-reflect:jar:2.10.4 in the shaded jar.
[INFO] Including com.thoughtworks.paranamer:paranamer:jar:2.6 in the shaded jar.
[INFO] Including com.fasterxml.jackson.datatype:jackson-datatype-jdk8:jar:2.4.4 in the shaded jar.
[INFO] Including com.fasterxml.jackson.datatype:jackson-datatype-jsr310:jar:2.4.4 in the shaded jar.
[INFO] Including com.typesafe.akka:akka-cluster_2.10:jar:2.3.13 in the shaded jar.
[INFO] Including com.beust:jcommander:jar:1.27 in the shaded jar.
[INFO] Including javax.ws.rs:javax.ws.rs-api:jar:2.0 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-ui-model:jar:0.9.1 in the shaded jar.
[INFO] Including org.agrona:Agrona:jar:0.5.4 in the shaded jar.
[INFO] Including org.mapdb:mapdb:jar:3.0.5 in the shaded jar.
[INFO] Including org.jetbrains.kotlin:kotlin-stdlib:jar:1.0.7 in the shaded jar.
[INFO] Including org.jetbrains.kotlin:kotlin-runtime:jar:1.0.7 in the shaded jar.

[INFO] Including org.eclipse.collections:eclipse-collections-api:jar:7.1.1 in the shaded jar.
[INFO] Including net.jcip:jcip-annotations:jar:1.0 in the shaded jar.
[INFO] Including org.eclipse.collections:eclipse-collections:jar:7.1.1 in the shaded jar.
[INFO] Including org.eclipse.collections:eclipse-collections-forkjoin:jar:7.1.1 in the shaded jar.
[INFO] Including net.jpountz.lz4:lz4:jar:1.3.0 in the shaded jar.
[INFO] Including org.mapdb:elsa:jar:3.0.0-M5 in the shaded jar.
[INFO] Including org.xerial:sqlite-jdbc:jar:3.15.1 in the shaded jar.
[INFO] Including org.deeplearning4j:deeplearning4j-ui-resources:jar:0.9.1 in the shaded jar.
[INFO] Including com.google.guava:guava:jar:19.0 in the shaded jar.
[INFO] Including org.datavec:datavec-data-codec:jar:0.9.1 in the shaded jar.
[INFO] Including org.jcodec:jcodec:jar:0.1.5 in the shaded jar.
[INFO] Including jfree:jfreechart:jar:1.0.13 in the shaded jar.
[INFO] Including jfree:jcommon:jar:1.0.16 in the shaded jar.
[INFO] Including org.jfree:jcommon:jar:1.0.23 in the shaded jar.
[WARNING] findbugs-annotations-1.3.9-1.jar, annotations-2.0.1.jar define 22 overlapping classes:
[WARNING]   - edu.umd.cs.findbugs.annotations.Nullable
[WARNING]   - edu.umd.cs.findbugs.annotations.NonNull
[WARNING]   - edu.umd.cs.findbugs.annotations.OverrideMustInvoke
[WARNING]   - edu.umd.cs.findbugs.annotations.PossiblyNull
[WARNING]   - edu.umd.cs.findbugs.annotations.DefaultAnnotationForMethods
[WARNING]   - edu.umd.cs.findbugs.annotations.CheckReturnValue
[WARNING]   - edu.umd.cs.findbugs.annotations.SuppressWarnings
[WARNING]   - edu.umd.cs.findbugs.annotations.DefaultAnnotationForFields
[WARNING]   - edu.umd.cs.findbugs.annotations.When
[WARNING]   - edu.umd.cs.findbugs.annotations.DischargesObligation
[WARNING]   - 12 more...
[WARNING] leveldbjni-all-1.7.jar, leveldbjni-1.7.jar define 45 overlapping classes:
[WARNING]   - org.fusesource.leveldbjni.internal.NativeObject
[WARNING]   - org.fusesource.leveldbjni.internal.NativeDB$DBJNI
[WARNING]   - org.fusesource.leveldbjni.internal.NativeIterator$IteratorJNI
[WARNING]   - org.fusesource.leveldbjni.internal.Util
[WARNING]   - org.fusesource.leveldbjni.internal.NativeCache
[WARNING]   - org.fusesource.leveldbjni.internal.NativeStdString
[WARNING]   - org.fusesource.leveldbjni.internal.NativeStatus
[WARNING]   - org.fusesource.leveldbjni.internal.Util$UtilJNI
[WARNING]   - org.fusesource.leveldbjni.internal.NativeComparator$ComparatorJNI
[WARNING]   - org.fusesource.leveldbjni.internal.NativeIterator
[WARNING]   - 35 more...
[WARNING] hawtjni-runtime-1.8.jar, leveldbjni-all-1.7.jar define 16 overlapping classes:
[WARNING]   - org.fusesource.hawtjni.runtime.Library
[WARNING]   - org.fusesource.hawtjni.runtime.ArgFlag
[WARNING]   - org.fusesource.hawtjni.runtime.JniMethod
[WARNING]   - org.fusesource.hawtjni.runtime.NativeStats
[WARNING]   - org.fusesource.hawtjni.runtime.NativeStats$StatsInterface
[WARNING]   - org.fusesource.hawtjni.runtime.MethodFlag
[WARNING]   - org.fusesource.hawtjni.runtime.ClassFlag
[WARNING]   - org.fusesource.hawtjni.runtime.NativeStats$NativeFunction
[WARNING]   - org.fusesource.hawtjni.runtime.PointerMath
[WARNING]   - org.fusesource.hawtjni.runtime.Callback
[WARNING]   - 6 more...
[WARNING] leveldb-api-0.5.jar, leveldbjni-all-1.7.jar define 13 overlapping classes:
[WARNING]   - org.iq80.leveldb.ReadOptions
[WARNING]   - org.iq80.leveldb.WriteBatch

```
[WARNING]   - org.iq80.leveldb.WriteOptions
[WARNING]   - org.iq80.leveldb.Snapshot
[WARNING]   - org.iq80.leveldb.DBComparator
[WARNING]   - org.iq80.leveldb.DB
[WARNING]   - org.iq80.leveldb.DBFactory
[WARNING]   - org.iq80.leveldb.CompressionType
[WARNING]   - org.iq80.leveldb.Logger
[WARNING]   - org.iq80.leveldb.Options
[WARNING]   - 3 more...
[WARNING] jcip-annotations-1.0.jar, annotations-2.0.1.jar define 4 overlapping classes:
[WARNING]   - net.jcip.annotations.GuardedBy
[WARNING]   - net.jcip.annotations.NotThreadSafe
[WARNING]   - net.jcip.annotations.ThreadSafe
[WARNING]   - net.jcip.annotations.Immutable
[WARNING] jcommon-1.0.16.jar, jcommon-1.0.23.jar define 209 overlapping classes:
[WARNING]   - org.jfree.ui.about.SystemPropertiesPanel$PopupListener
[WARNING]   - org.jfree.ui.ArrowPanel
[WARNING]   - org.jfree.ui.Spinner
[WARNING]   - org.jfree.text.TextBox
[WARNING]   - org.jfree.ui.action.ActionRadioButton
[WARNING]   - org.jfree.util.LogTarget
[WARNING]   - org.jfree.ui.action.ActionButton$ActionEnablePropertyChangeHandler
[WARNING]   - org.jfree.threads.ReaderWriterLock
[WARNING]   - org.jfree.util.ClassComparator
[WARNING]   - org.jfree.date.DateUtilities
[WARNING]   - 199 more...
[WARNING] maven-shade-plugin has detected that some class files are
[WARNING] present in two or more JARs. When this happens, only one
[WARNING] single version of the class is copied to the uber jar.
[WARNING] Usually this is not harmful and you can skip these warnings,
[WARNING] otherwise try to manually exclude artifacts based on
[WARNING] mvn dependency:tree -Ddetail=true and the above output.
[WARNING] See http://maven.apache.org/plugins/maven-shade-plugin/
[INFO] Attaching shaded artifact.
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 01:00 min
[INFO] Finished at: 2017-12-06T18:15:18-05:00
[INFO] Final Memory: 70M/640M
[INFO] ------------------------------------------------------------------------
```

As you can see, the JAR file is built successfully. The maven package plugin creates two

JAR files:

1. irrigation-recommendation-system-1.1-IRSArtifact.jar
2. irrigation-recommendation-system-1.1.jar

The second file is the shaded jar and executes the IRS product. The IRS GUI is loaded when the irrigation-recommendation-system-1.1.jar file is opened.

This JAR file successfully accomplishes system features 1 and 2 with no problems; however, system features 3-6 don't work properly.

System Features 3 and 4 (train model and ask to save the parameters) produce the following error:

```
Exception in thread "AWT-EventQueue-0" java.lang.NoClassDefFoundError:
org/deeplearning4j/nn/conf/layers/Layer
        at GUI.configureModel(GUI.java:181)
        at GUI$TrainListener.actionPerformed(GUI.java:433)
        at javax.swing.AbstractButton.fireActionPerformed(AbstractButton.java:2022)
        at javax.swing.AbstractButton$Handler.actionPerformed(AbstractButton.java:2348)
        at javax.swing.DefaultButtonModel.fireActionPerformed(DefaultButtonModel.java:402)
        at javax.swing.DefaultButtonModel.setPressed(DefaultButtonModel.java:259)
        at javax.swing.plaf.basic.BasicButtonListener.mouseReleased(BasicButtonListener.java:252)
        at java.awt.Component.processMouseEvent(Component.java:6533)
        at javax.swing.JComponent.processMouseEvent(JComponent.java:3324)
        at java.awt.Component.processEvent(Component.java:6298)
        at java.awt.Container.processEvent(Container.java:2236)
        at java.awt.Component.dispatchEventImpl(Component.java:4889)
        at java.awt.Container.dispatchEventImpl(Container.java:2294)
        at java.awt.Component.dispatchEvent(Component.java:4711)
        at java.awt.LightweightDispatcher.retargetMouseEvent(Container.java:4888)
        at java.awt.LightweightDispatcher.processMouseEvent(Container.java:4525)
        at java.awt.LightweightDispatcher.dispatchEvent(Container.java:4466)
        at java.awt.Container.dispatchEventImpl(Container.java:2280)
        at java.awt.Window.dispatchEventImpl(Window.java:2746)
        at java.awt.Component.dispatchEvent(Component.java:4711)
        at java.awt.EventQueue.dispatchEventImpl(EventQueue.java:758)
        at java.awt.EventQueue.access$500(EventQueue.java:97)
        at java.awt.EventQueue$3.run(EventQueue.java:709)
        at java.awt.EventQueue$3.run(EventQueue.java:703)
        at java.security.AccessController.doPrivileged(Native Method)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:80)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:90)
        at java.awt.EventQueue$4.run(EventQueue.java:731)
```

```
        at java.awt.EventQueue$4.run(EventQueue.java:729)
        at java.security.AccessController.doPrivileged(Native Method)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:80)
        at java.awt.EventQueue.dispatchEvent(EventQueue.java:728)
        at java.awt.EventDispatchThread.pumpOneEventForFilters(EventDispatchThread.java:201)
        at java.awt.EventDispatchThread.pumpEventsForFilter(EventDispatchThread.java:116)
        at java.awt.EventDispatchThread.pumpEventsForHierarchy(EventDispatchThread.java:105)
        at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.java:101)
        at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.java:93)
        at java.awt.EventDispatchThread.run(EventDispatchThread.java:82)
Caused by: java.lang.ClassNotFoundException: org.deeplearning4j.nn.conf.layers.Layer
        at java.net.URLClassLoader.findClass(URLClassLoader.java:381)
        at java.lang.ClassLoader.loadClass(ClassLoader.java:424)
        at sun.misc.Launcher$AppClassLoader.loadClass(Launcher.java:331)
        at java.lang.ClassLoader.loadClass(ClassLoader.java:357)
          ... 38 more
```

As you can see from the exception, the problem is that the JAR cannot find the org/deeplearning4j/nn/conf/layers/Layer package. However, if you look at the maven package build outcome, you see that this package is clearly included in the shaded jar ([INFO] Including org.deeplearning4j:deeplearning4j-nn:jar:0.9.1 in the shaded jar.). The Skymind staff reviewed my pom.xml file and couldn't help resolve this issue. I have no resolution for this dependency issue.

System Feature 3 (train model and don't ask to save the parameters) produces the following error:

```
Exception in thread "AWT-EventQueue-0" java.lang.NoClassDefFoundError:
org/nd4j/linalg/dataset/api/DataSet
        at GUI.configureModel(GUI.java:181)
        at GUI$TrainListener.actionPerformed(GUI.java:433)
        at javax.swing.AbstractButton.fireActionPerformed(AbstractButton.java:2022)
        at javax.swing.AbstractButton$Handler.actionPerformed(AbstractButton.java:2348)
        at javax.swing.DefaultButtonModel.fireActionPerformed(DefaultButtonModel.java:402)
        at javax.swing.DefaultButtonModel.setPressed(DefaultButtonModel.java:259)
        at javax.swing.plaf.basic.BasicButtonListener.mouseReleased(BasicButtonListener.java:252)
        at java.awt.Component.processMouseEvent(Component.java:6533)
        at javax.swing.JComponent.processMouseEvent(JComponent.java:3324)
        at java.awt.Component.processEvent(Component.java:6298)
```

```
        at java.awt.Container.processEvent(Container.java:2236)
        at java.awt.Component.dispatchEventImpl(Component.java:4889)
        at java.awt.Container.dispatchEventImpl(Container.java:2294)
        at java.awt.Component.dispatchEvent(Component.java:4711)
        at java.awt.LightweightDispatcher.retargetMouseEvent(Container.java:4888)
        at java.awt.LightweightDispatcher.processMouseEvent(Container.java:4525)
        at java.awt.LightweightDispatcher.dispatchEvent(Container.java:4466)
        at java.awt.Container.dispatchEventImpl(Container.java:2280)
        at java.awt.Window.dispatchEventImpl(Window.java:2746)
        at java.awt.Component.dispatchEvent(Component.java:4711)
        at java.awt.EventQueue.dispatchEventImpl(EventQueue.java:758)
        at java.awt.EventQueue.access$500(EventQueue.java:97)
        at java.awt.EventQueue$3.run(EventQueue.java:709)
        at java.awt.EventQueue$3.run(EventQueue.java:703)
        at java.security.AccessController.doPrivileged(Native Method)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:80)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:90)
        at java.awt.EventQueue$4.run(EventQueue.java:731)
        at java.awt.EventQueue$4.run(EventQueue.java:729)
        at java.security.AccessController.doPrivileged(Native Method)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:80)
        at java.awt.EventQueue.dispatchEvent(EventQueue.java:728)
        at java.awt.EventDispatchThread.pumpOneEventForFilters(EventDispatchThread.java:201)
        at java.awt.EventDispatchThread.pumpEventsForFilter(EventDispatchThread.java:116)
        at java.awt.EventDispatchThread.pumpEventsForHierarchy(EventDispatchThread.java:105)
        at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.java:101)
        at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.java:93)
        at java.awt.EventDispatchThread.run(EventDispatchThread.java:82)
Caused by: java.lang.ClassNotFoundException: org.nd4j.linalg.dataset.api.DataSet
        at java.net.URLClassLoader.findClass(URLClassLoader.java:381)
        at java.lang.ClassLoader.loadClass(ClassLoader.java:424)
        at sun.misc.Launcher$AppClassLoader.loadClass(Launcher.java:331)
        at java.lang.ClassLoader.loadClass(ClassLoader.java:357)
        ... 38 more
```

As you can see from the exception, the problem is that the JAR cannot find the org/nd4j/linalg/dataset/api/DataSet package. However, if you look at the maven package build outcome, you see that this package is clearly included in the shaded jar ([INFO] Including org.nd4j:nd4j-api:jar:0.9.1 in the shaded jar.). The Skymind staff reviewed my pom.xml file and couldn't help resolve this issue. I have no resolution for this dependency issue.

System Feature 5 (load model from saved parameters) produces the following error:

```
Exception in thread "AWT-EventQueue-0" java.lang.NoClassDefFoundError:
org/nd4j/linalg/dataset/api/DataSet
        at GUI.configureModel(GUI.java:195)
        at GUI$LoadListener.actionPerformed(GUI.java:498)
        at javax.swing.AbstractButton.fireActionPerformed(AbstractButton.java:2022)
        at javax.swing.AbstractButton$Handler.actionPerformed(AbstractButton.java:2348)
        at javax.swing.DefaultButtonModel.fireActionPerformed(DefaultButtonModel.java:402)
        at javax.swing.DefaultButtonModel.setPressed(DefaultButtonModel.java:259)
        at javax.swing.plaf.basic.BasicButtonListener.mouseReleased(BasicButtonListener.java:252)
        at java.awt.Component.processMouseEvent(Component.java:6533)
        at javax.swing.JComponent.processMouseEvent(JComponent.java:3324)
        at java.awt.Component.processEvent(Component.java:6298)
        at java.awt.Container.processEvent(Container.java:2236)
        at java.awt.Component.dispatchEventImpl(Component.java:4889)
        at java.awt.Container.dispatchEventImpl(Container.java:2294)
        at java.awt.Component.dispatchEvent(Component.java:4711)
        at java.awt.LightweightDispatcher.retargetMouseEvent(Container.java:4888)
        at java.awt.LightweightDispatcher.processMouseEvent(Container.java:4525)
        at java.awt.LightweightDispatcher.dispatchEvent(Container.java:4466)
        at java.awt.Container.dispatchEventImpl(Container.java:2280)
        at java.awt.Window.dispatchEventImpl(Window.java:2746)
        at java.awt.Component.dispatchEvent(Component.java:4711)
        at java.awt.EventQueue.dispatchEventImpl(EventQueue.java:758)
        at java.awt.EventQueue.access$500(EventQueue.java:97)
        at java.awt.EventQueue$3.run(EventQueue.java:709)
        at java.awt.EventQueue$3.run(EventQueue.java:703)
        at java.security.AccessController.doPrivileged(Native Method)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:80)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:90)
        at java.awt.EventQueue$4.run(EventQueue.java:731)
        at java.awt.EventQueue$4.run(EventQueue.java:729)
        at java.security.AccessController.doPrivileged(Native Method)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:80)
        at java.awt.EventQueue.dispatchEvent(EventQueue.java:728)
        at java.awt.EventDispatchThread.pumpOneEventForFilters(EventDispatchThread.java:201)
        at java.awt.EventDispatchThread.pumpEventsForFilter(EventDispatchThread.java:116)
        at java.awt.EventDispatchThread.pumpEventsForHierarchy(EventDispatchThread.java:105)
        at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.java:101)
        at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.java:93)
        at java.awt.EventDispatchThread.run(EventDispatchThread.java:82)
Caused by: java.lang.ClassNotFoundException: org.nd4j.linalg.dataset.api.DataSet
        at java.net.URLClassLoader.findClass(URLClassLoader.java:381)
        at java.lang.ClassLoader.loadClass(ClassLoader.java:424)
        at sun.misc.Launcher$AppClassLoader.loadClass(Launcher.java:331)
        at java.lang.ClassLoader.loadClass(ClassLoader.java:357)
```

```
    ... 38 more
```

As you can see from the exception, the problem is that the JAR cannot find the org/deeplearning4j/nn/conf/layers/Layer package. However, if you look at the maven package build outcome, you see that this package is clearly included in the shaded jar ([INFO] Including org.deeplearning4j:deeplearning4j-nn:jar:0.9.1 in the shaded jar.). The Skymind staff reviewed my pom.xml file and couldn't help resolve this issue. I have no resolution for this dependency issue.

System Feature 6 (generate an irrigation recommendation report) , obviously won't work because the model hasn't been trained or loaded from file. Regardless it produces the following error:

```
Exception in thread "AWT-EventQueue-0" java.lang.NullPointerException
        at GUI$GenerateListener.actionPerformed(GUI.java:543)
        at javax.swing.AbstractButton.fireActionPerformed(AbstractButton.java:2022)
        at javax.swing.AbstractButton$Handler.actionPerformed(AbstractButton.java:2348)
        at javax.swing.DefaultButtonModel.fireActionPerformed(DefaultButtonModel.java:402)
        at javax.swing.DefaultButtonModel.setPressed(DefaultButtonModel.java:259)
        at javax.swing.plaf.basic.BasicButtonListener.mouseReleased(BasicButtonListener.java:252)
        at java.awt.Component.processMouseEvent(Component.java:6533)
        at javax.swing.JComponent.processMouseEvent(JComponent.java:3324)
        at java.awt.Component.processEvent(Component.java:6298)
        at java.awt.Container.processEvent(Container.java:2236)
        at java.awt.Component.dispatchEventImpl(Component.java:4889)
        at java.awt.Container.dispatchEventImpl(Container.java:2294)
        at java.awt.Component.dispatchEvent(Component.java:4711)
        at java.awt.LightweightDispatcher.retargetMouseEvent(Container.java:4888)
        at java.awt.LightweightDispatcher.processMouseEvent(Container.java:4525)
        at java.awt.LightweightDispatcher.dispatchEvent(Container.java:4466)
        at java.awt.Container.dispatchEventImpl(Container.java:2280)
        at java.awt.Window.dispatchEventImpl(Window.java:2746)
        at java.awt.Component.dispatchEvent(Component.java:4711)
        at java.awt.EventQueue.dispatchEventImpl(EventQueue.java:758)
        at java.awt.EventQueue.access$500(EventQueue.java:97)
        at java.awt.EventQueue$3.run(EventQueue.java:709)
        at java.awt.EventQueue$3.run(EventQueue.java:703)
        at java.security.AccessController.doPrivileged(Native Method)
        at
```

```
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:80)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:90)
        at java.awt.EventQueue$4.run(EventQueue.java:731)
        at java.awt.EventQueue$4.run(EventQueue.java:729)
        at java.security.AccessController.doPrivileged(Native Method)
        at
java.security.ProtectionDomain$JavaSecurityAccessImpl.doIntersectionPrivilege(ProtectionDomain.java:80)
        at java.awt.EventQueue.dispatchEvent(EventQueue.java:728)
        at java.awt.EventDispatchThread.pumpOneEventForFilters(EventDispatchThread.java:201)
        at java.awt.EventDispatchThread.pumpEventsForFilter(EventDispatchThread.java:116)
        at java.awt.EventDispatchThread.pumpEventsForHierarchy(EventDispatchThread.java:105)
        at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.java:101)
        at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.java:93)
          at java.awt.EventDispatchThread.run(EventDispatchThread.java:82)
```

This exception occurs because no model could be loaded. This feature would be fixed if features 3-5 functioned properly.

None of these issues could be resolved because the project ran out of time. Please note all functionality exists in the development environment (IntelliJ), so this is a deployment issue.

Appendix A: References

The following table summarizes the documents referenced in this document.

Project Definition Report

Version	1.2
Date	10/5/2017
Author	Raulie Raulerson

Software Design Description (SDD)

Version	1.3
Date	12/5/2017
Author	Raulie Raulerson

Software Requirements Specification (SRS)

Version	1.7
Date	12/4/2017
Author	Raulie Raulerson

Software Project Management Plan (SPMP)

Version	1.5
Date	12/4/2017
Author	Raulie Raulerson

Risk Management Plan

Version	1.5
Date	12/4/2017
Author	Raulie Raulerson

Note: The template for this Software Testing Document was obtained from

http://www.opencodez.com/wp-content/uploads/2017/07/Test_Plan_Template.docx.

Appendix B: Key Terms

API – Application Programming Interface

CSV – Comma-Separated Values

DL4J – DeepLearning4J

EC – Electrical Conductivity

ET – Evapotranspiration

FDACS – Florida Department of Agriculture and Consumer Services

GUI – Graphical User Interface

IDE – Integrated Development Environment

IRS – Irrigation Recommendation System

JAR – Java Archive

JRE – Java Runtime Environment

OS – Operating System

POM – Project Object Model

RNN – Recurrent Neural Network

SBDTS - Software Budget and Detailed Timeline Spreadsheet

SDD – Software Design Description

SDLC – Software Development Life Cycle

SPMP – Software Project Management Plan

SMS – Soil Moisture Sensor

SRS – Software Requirements Specification

STD – Software Testing Document

UI – User Interface

VWC – Volumetric Water Content