Student Worksheet: Analyzing a Journal Article

Please read the assigned journal article and answer the following questions. Review the "Paraphrasing" module as needed to help you understand how to paraphrase to avoid plagiarism.

Your name: Hudema Dumitru Tiberiu **Date:** 14/12/2019

Journal article title: An IoT based smart irrigation management system using Machine learning and open source technologies

Step 1. What is the purpose/hypothesis/aim/objective of the study?	
a. Write down the exact statement in which the authors describe what they were testing. (Hint: This information may be provided in the article as a purpose statement or as a hypothesis). Include quotation marks around the exact wording, and indicate page number(s).	"To verify the accuracy of soil moisture prediction algorithm, the hourly feld data for air temperature, air humidity, soil moisture, soil temperature, and UV is collected for three weeks." (page 48)
b. Now describe the purpose of the study (as you understand it) in your own words.	The main objective of the study is to make the irrigation of the fields a process that will not waste water, keeping it in the right spot all the time (when set to auto), also taking into consideration the upcoming precipitations. This is also because of the water shortage that some areas deal with, but also crops that stop growing because of excess water.
c. What was the "gap" in the research that the authors were trying to fill by doing their study?	The authors felt there is a need to predict the soil moisture with accuracy for the next days (taking into consideration all the external environment variables) in order to have a proper irrigation management with as little water waste as possible in the end.

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Step 2. What is/are the major finding(s) of the study?	
a. Make some notes about the authors' <u>major</u> conclusions or findings as written in the article. Include quotation marks whenever you use their exact wording, and indicate page number(s).	"So, we have considered evaporation of soil moisture based on air temperature, air relative humidity, soil temperature, and radiation. The parameters are considered for analyzing the soil moisture drain (change/ difference) pattern based on the recorded data of soil moisture."(p.42) "An algorithm based on a combination of supervised and unsupervised machine learning techniques [...] has been developed using Support Vector Regression (SVR) and k-means clustering for estimation of difference/change in soil moisture due to weather conditions.(p. 42-43) " Due to higher accuracy and minimum MSE, SVR + k-means based hybrid machine learning algorithm has been used in irrigation planning module." (p.49)
b. Now write those conclusions (as you understand them) in your own words.	The first step was to identify which environment variable are the best candidates in order to obtain accurate results at predicting soil moisture. After comparing multiple ways of calculating it and reaching a conclusion, the biggest and most important part was the actual machine learning algorithm (with good accuracy) that would combine all those input parameters and would come with some predictions for soil moisture, and also some proposed schedule for irrigating, taking into consideration also the upcoming weather forecasts.
Step 3. How did the authors test their hypothesis?	
a. Briefly summarize the main steps or measurements that the authors used in their methods. Try to explain in your own words as much as possible.	In order to have some results from the ML algorithm, it had to be trained first. After everything was ready, they had reading for 3 weeks from all the sensors. They also had a soil moisture sensor in the same place, in order to check if the predictions match the sensor. Those 3 weeks were split in 70% training data, and 30% test data, to check if the algorithm is accurate. They also tried multiple versions of the algorithm to see which one is better (SVR vs. SVR + k-means)
b. Do the authors suggest any problems or limitations with their methodology? Do you see any problems or limitations with their methodology?	The authors did not suggest any problem on their methodology, but being a prediction algorithm, we can't expect a 100% rate of successful predictions, even if the accuracy was 96% (table 5). Considering that the training and test data was done in a 3-weeks span, my concern would be if that still fits for other seasons, especially winter, and if it works just as well in any kind of climate without generating new test data for another month.
c. How did the authors analyse their data? What test/s did they use?	Comparison of prediction based on sensors, with an actual sensor that would measure the value for the date of prediction. (So if they had a predictions for 24/12/2019, a soil moisture sensor would read the actual value in that date and then they would check the accuracy).

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Step 4. How reliable are the results?	
a. Do the authors suggest any problems with the study that could lead to unreliable results?	Just being a machine learning algorithm, and doing predictions, so it starts from the premise that the results will never be 100% accurate.
Step 5. Based on your analysis, are the claims made in this journal article accurate?	
a. Do the conclusions made (about the results) by the author make sense to you? Are the conclusions too broad or too narrow based on what was actually done in the study?	I consider the conclusions to be good, all the parts that reference the study were discussed in the article, and it even comes with some future steps that the authors intent to do in order to improve the current system.
b. Based on the accuracy of the methodology and the reliability of the results as described in Steps 3 and 4, do you think the conclusions can be believed?	Yes, considering all the factors of the study, and the obtained results, I believe that the conclusions can be believed.

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Step 6. What is the importance of this scientific work?	
a. Write (in your own words) the significant contributions of the experimental work in this journal article as reported by the authors.	The significant contribution of this work was to obtain affordable, yet accurate way of determining when the irrigation process should happen, and never excess with the water of the plant, with the main purpose to make water economy (because of a shortage in some areas, and as population is growing, it will be a less and less easy to find the needed amount of fresh water if the waste continues), and the agriculture sector is one of the biggest consumers of water.
b. Re-read your notes and explain why you think this is ○ **a strong or weak scientific article** ○ a **strong or weak scientific study**	I consider this is a strong article. It came with measurements, the algorithms were presented in a pseudo-code format, the whole process and context of taking the important decisions were presented, and also some images of the architecture and of the physical devices used were present.

Resources for students:

1. If you are struggling with plagiarism and paraphrasing, then refer to our online "Paraphrasing" module.
2. If you are struggling with figuring out how to read the information, then refer to the section on active reading in the "Learning from Textbooks" section of A Guide for University Learning.
3. If you want to learn how to find more academic information on other science topics, then refer to our online "Searching for Scientific Journal Articles" module.

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