

Lab Submission Worksheet

Laboratory 4 — SpO2

Lab Group: _____

Date: _____

Student 1

Student 2

Name: _____

Name: _____

Student number: _____

Student number: _____

Instructions

Step 1

Complete the Lab and take screenshots requested. They will be used to answer the questions.

Step 2

Print and attach the following labeled plots:

1. Plot of unprocessed and processed Pulse Rate data for one ‘testing’ file.
2. One ‘Testing’ file: For 1 subject, plot your data in the required format (see report B) (adding appropriate titles and axis labels), and indicate on the breathing plot where the type of breathing changes.
3. For the ‘Hold_Inhale’ files. Plot the resp. signal and indicate where breath hold starts and ends.
4. For the ‘Hold_Exhale’ files. Plot the resp. signal and indicate where breath hold starts and ends.
5. Plot to support your answer to question i)v: Does running cause motion artefact in any of the signals?

Step 3

Write your answer to all questions in the provided boxes.

Step 4

Submit to the drop box for “sysc4203” outside ME4460 before **2:00pm** one week after the lab.

Report

- a. Plot your unprocessed and processed Pulse Rate data for one ‘testing’ file.

Attach and label plot.

- i. What is the mean Pulse Rate for the entire Pulse Rate channel for the unprocessed and processed data? Is the second value realistic? (Hint: should be close to your HR).

- ii. Attach your Matlab code.

- b. One ‘Testing’ file: For 1 subject, plot your data in the following format (adding appropriate titles & axis labels), and indicate on the breathing plot where the type of breathing changes.

```
ax(1) = subplot(4,1,1);  
plot(testing_subject1(:,1));  
ax(2) = subplot(4,1,2);  
plot(testing_subject1(:,2));  
ax(3) = subplot(4,1,3); plot(testing_subject1_processed(:,3));  
ax(4) = subplot(4,1,4);  
plot(testing_subject1_processed(:,4)); linkaxes(ax,'x');
```

Attach and label plots.

- c. Testing' files: For each type of breathing (Br.) (regular, fast, slow and abdomen) find: i) the average breathing rate (in breaths per minute), ii) the average breathing amplitude (note the units the amplitude is measured in is somewhat meaningless because it corresponds to the sensor but the relative amplitudes are meaningful), iii) the average SpO₂, and iv) average Pulse rate (using the 'Pulse' not the ECG data) and fill in the table below. Indicate units.

	Reg. Br. (bpm =)			Fast Br. (bpm =)			Slow Br. (bpm =)			Abdomen Br. (bpm =)		
	Br. amp.	SpO ₂	Pulse	Br. amp.	SpO ₂	Pulse	Br. amp.	SpO ₂	Pulse	Br. amp.	SpO ₂	Pulse
Subject 1												
Subject 2												
Subject 3												

Comparing the Reg. Br. to the Fast Br., what was the effect of hyperventilation on SpO₂? Pulse? What was the increase/reduction (in %) of the resp. signal amplitude?

- i. Knowing the sampling rate of the resp. sensor, how fast would you have to breathe to avoid detection? Show your calculations and specify units.

ii. Comparing Reg. Br. to Slow Br., what was the effect of hypoventilation on SpO₂? Pulse? What was the increase/reduction (in %) of the resp. signal amplitude?

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iii. Comparing Reg. Br. to Abdomen Br., was a breathing signal detected? If so what was the reduction (in %) of the resp. signal when breathing with the abdomen?

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iv. Discuss the relationship between breathing, SpO₂ and pulse rate (does pulse rate increase/decrease with SpO₂). Explain why it's a good thing that the relationships work this way (200 words).

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- d. 'Hold_Exhale' files. Plot the resp. signal and indicate where breath hold starts and ends.

Attach and label plot.

- i. What is the pulse rate at beginning and end of the breath hold? How long after resuming breathing did the value return to normal (if this happens during collection time period)?

- ii. What is the SpO₂ at beginning and end of the breath hold? How long after resuming breathing did the value return to normal (if this happens during collection time period)?

- iii. How long (in seconds) did it take for the SpO₂ to decrease by 1%? 2%? 3%? (and so on till lowest value). How long to increase by 1%? 2%? Mark these time intervals on the SpO₂ plot.

e. 'Hold_Inhale' files. Plot the resp. signal and indicate where breath hold starts and ends.

Attach and label plot.

i. What is the pulse rate at beginning and end of the breath hold? How long after resuming breathing did the value return to normal (if this happens during collection time period)?

ii. What is the SpO₂ at beginning and end of the breath hold? How long after resuming breathing did the value return to normal (if this happens during collection time period)?

iii. How long (in seconds) did it take for the SpO₂ to decrease by 1%? 2%? 3%? (and so on till lowest value). How long to increase by 1%? 2%? Mark these time intervals on the SpO₂ plot.

- h. 'Rest' files: Compare the heart rate value (in beats per minute) as determined by the pulse oximeter and by the ECG data (using 10 beats for the beginning, middle and end of your file). How similar/different are the values? Why is there (or not) a difference between the two measurement methods?

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- i. 'Running' files:

- i. What changed in the respiratory effort signal? Why would this happen?

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- ii. What changed in the SpO₂ signal? Why would this happen?

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- changed in the Pulse rate signal? Why would this happen?

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iii. What changed in the ECG signal? Why would this happen?

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iv. Does running cause motion artefact in any of the signals? Why? If so, show a plot to support your answer.

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j. 'Running' files:

i. How long did it take for the pulse rate and breathing rate signal to return to Reg. Br. or 'at rest' values?

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ii. How long did it take for the pulse rate and breathing rate signal to return to Reg. Br. or 'at rest' values?

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