Practical 1: Fundamentals of Sensing, Setting up devices

Overview

Over the next couple of days, you will be collecting and analysing your own data using 2 devices: a wearable camera and an accelerometer.

By going through this practical, we hope that you will learn more about how innovative technologies such as wearable cameras and accelerometers are being used in health and social research. You might also find it interesting to see how many different activities you do in a day and where you spend the majority of your time.

Our road map will look like this:

1. Set up devices and collect your own data.
2. Extract and annotate wearable camera data.
3. Extract and annotate accelerometer data.
4. Time-series analysis and machine learning.
5. Visualise your data for a presentation on Friday!
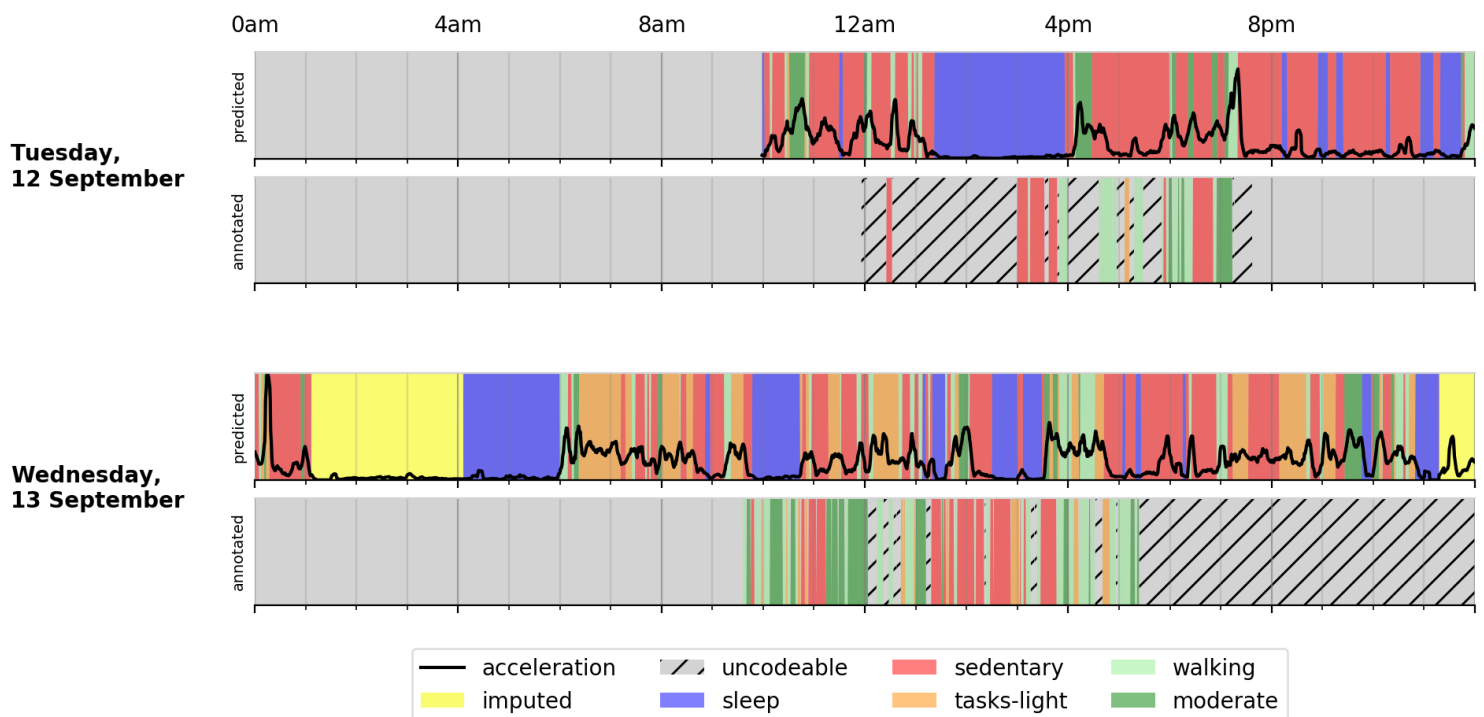
Today

In this practical, we'll go through an ethics training and set up your devices to collect data. By the end of the practical, you will be wearing your devices for two days until Practical 3, when you will begin analysis and visualisation of your very own data.

Miscellaneous

All the commands will work on Linux and Mac. First, you will need to clone the repo on your own machine by:

```
$ cd ~/Development/
$ git clone https://github.com/activityMonitoring/wearable-teaching.git
```

1. Ethics background reading

As you may be aware, various ethical issues can stem from research using image-based data. It is important that all researchers involved go through an ethics training to familiarise themselves of related ethical issues.

Your ethics training will consists of going through a list of necessary reading materials as well as passing an online certificated course.

A. Reading list

- Background Information.

- Kelly, P., Marshall, S.J., Badland, H., Kerr, J., Oliver, M., Doherty, A.R., Foster, C. (2013) An Ethical Framework for automated-wearable cameras in health behaviour research. American Journal of Preventive Medicine 44(3); 314-319

- Parts A & B of Cox, S. Drew, S. Guillemin, M. Howell, C. Warr, D. and Waycott, J. (2014) Guidelines for Ethical Visual Research Methods, The University of Melbourne, Melbourne

- Doherty, A.R., Williamson, W., Hillsdon, M., Hodges, S., Foster, C., Kelly, P. (2013) Influencing health-related behaviour with wearable cameras: strategies & ethical considerations. Proceedings of SenseCam and Pervasive Imaging Conference, San Diego, USA, November 18-19, 2013

B. Ethics declaration

You will need to complete the ethical declaration form in order to continue. This can be found at
`practicals/prac1_data_collection/declaration.pdf`

NB. You do not need to tick the part of the form indicating that you have completed the ethics training course. Aiden Doherty is the Principal Investigator.

Handin: Ethical Declaration (hard copy of `practicals/prac1_data_collection/declaration.pdf`) to Hang.

2. About your study.

The idea of this study is for you to create your own dataset using the wearable camera and accelerometer in order to have a taste of studies of this kind.

Please take a moment to go through the following background information before you begin collecting data. The text is chiefly about the wearable camera and has been adapted from an information sheet given to actual participants of the CAPTURE-24 study in 2015.

Camera

The camera is really helpful to get a better understanding of all the different activities you are involved in during the course of a day. The camera does not record continuously, but takes a photo every 30 seconds.
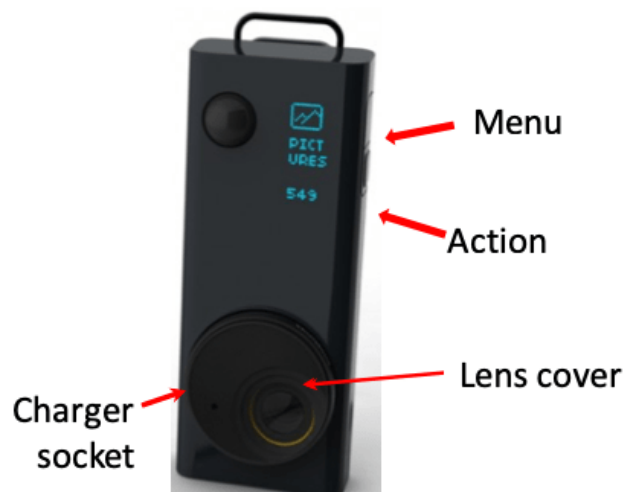
Instructions

- We kindly ask you to wear the camera for 2 consecutive days, at 3 different timepoints. When you decide to wear the camera the next day, make sure the camera is fully charged.
- We kindly ask you to wear the camera for all activities on those days, both at home and outside.
- You are free to take off or pause the device at any time, without giving a reason. However, please do put the device back on as soon as possible afterwards.
- Wear the camera around your neck so that it feels comfortable. The camera unit should be at chest height with the lens facing horizontally forwards.
- The height can be adjusted with the black cord (lanyard).
- Wear the camera outside of your clothes and be careful that your coat doesn't obscure the lens!
- There is also a clip, if you prefer to attach the camera to clothes.
- Try not get the camera wet.
- Make sure to charge the camera after you've used it for one day.

In a typical day of wear, the camera may take up to 3,000 images depicting your everyday life, where you go and the kinds of activities you engage in (e.g. walking to the shop, cycling, socialising). Some images are displayed below for you to get an idea of the content and quality of images that are recorded:

Disclaimer

- The camera does not record any sounds, voices or conversations.
- All images will be treated with the strictest confidence and you will be given the option to review and delete any or all images before analysis.
- Over the course of the data collection day you may forget you are wearing the camera and take images that are too personal, unwanted or unflattering. At the end of the period for which you are wearing the camera, you will have the opportunity to view and, if necessary, delete any images that you do not wish to be included in the study.

Ethics information on wearable cameras

The data collected will be anonymised and stored on a password-protected computer and any researchers using the data will have been trained in the ethical handling of such data. In a typical day of wear, the camera may take up to 3,000 images depicting your everyday life, where you go and the kinds of activities you engage in (e.g. walking to the shop, cycling, socialising). Some images are displayed below for you to get an idea of the content and quality of images that are recorded:
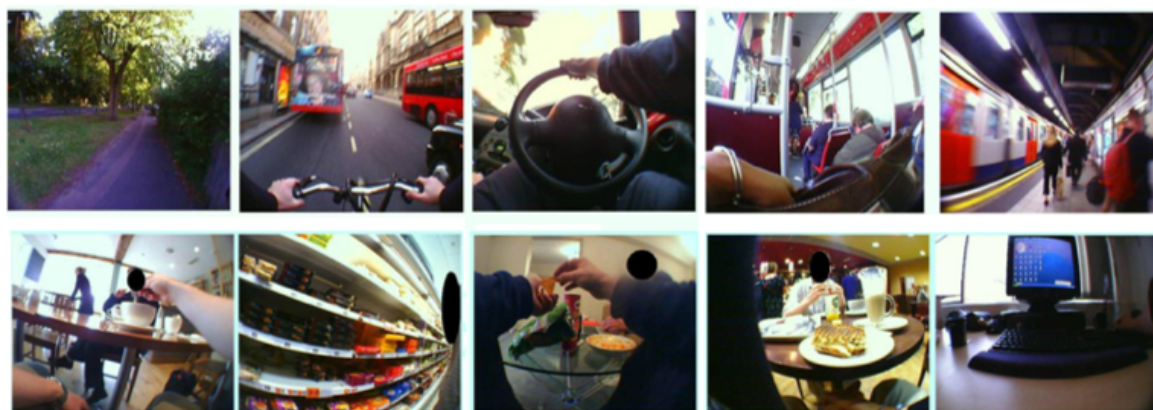
The devices are encrypted ('scrambled') so that the data can only be accessed by members of the research team. This restricts participants and/or third parties to access the images or make sense of them. Data of illegal activities may not be protected by confidentiality and may be passed to law enforcement. The camera does not record sound, voices, or conversations, so your privacy is assured in this regard.

It is important for you to understand that you are free to take off or pause the device at any time, without giving a reason. Pausing the camera for brief intervals throughout the day will not affect your input to the study. You should not feel obliged to wear the device in situations where wearing it may make you (or others) feel uncomfortable. If others around you feel uncomfortable with you wearing the camera, you should offer to remove or temporarily switch it off. Places where wearing the camera may not be appropriate include changing rooms, swimming pools, or in and around schools.

We recommend that you check in advance that friends, family, and co-workers understand the nature of the study and are happy for you to take part. Their behavior will not be reported as part of the research and images of them will never be shown without your and their written permission. They are welcome to contact the research team if they have any questions or concerns. If you are worried that the camera may have taken images of others that they would feel uncomfortable with, both you and the third party are free to request for those images to be deleted without giving any reason.

Over the course of the data collection day you may forget you are wearing the camera and take images that are too personal, unwanted or unflattering. At the end of the period for which you are wearing the camera, you will have the opportunity to view and, if necessary, delete any images that you do not wish to be included in the study.

Where and when can I wear the camera?

We are interested in recording your daily activities so we would like you to wear the camera as much as possible during your waking hours for one day. Once you have woken and showered, put on the camera. Please keep it on until you start preparing for bed that evening; you do not have to wear it whilst you are sleeping. You should not wear the camera while you or others are changing or undressing.

We appreciate that in some places (e.g. hospitals or airports) it may not be appropriate to wear the camera and you should feel free to remove it at any time. You do not need to wear the camera while participating in contact or water based sports (e.g. rugby or swimming), although we would like you to record your journey there and back.

Personal safety

Remove the camera in any situation where you feel unsafe. For example, if you happen to be out on your own late at night, you may prefer to hide the camera to avoid unwanted attention. If someone tries to take the camera off you, do not attempt to stop them.

If you are engaged in certain manual tasks or using machinery the camera sometimes swings around. For example, if you are using gardening machinery, we advise you remove the device until the activity is finished to avoid discomfort or the possibility of the device getting caught in a dangerous way.

Privacy

The lens cover can be rotated to give privacy when required. You do not need to turn the camera off. Remember to turn the lens cover back to allow images to be taken once you no longer need privacy. Some people find it easier to hide the camera under their clothing or in a pocket for short periods of privacy.

Do I have to collect my own data?

You are of course free to decide whether or not to collect your own data. There will be no penalty to you for not doing so.

What are the possible disadvantages of collecting this data?

We do not anticipate any significant effects on your lifestyle. If you do not want to answer any of the questions in the questionnaire or interview you do not have to. You will also be able to check and delete any images taken prior to anyone viewing the images. However, it is possible that while wearing the camera you may be asked about the device by members of the public. In this case we suggest that you say the following:

"I am volunteering for a research project. The device is a wearable camera and the images will be used to record my daily activities. I am happy to remove it if you would like me to."

You may also print out a wallet-size card which includes this statement and contact information for you to show others.

Accelerometer

The accelerometer is extremely robust and should be worn at all times. Do not worry if this is not a typical time for you (e.g. you are doing more or less physical activity than normal). Please start wearing it as soon as we give it to you. The accelerometer has a long battery life (at least a week), so you do not need to charge it. As it is completely silent, you will not be able to tell that it is running.

Please wear the accelerometer on the wrist of the hand that you usually use to write (i.e. your right wrist if you are right-handed). Generally this will be most convenient for people since it is typical to wear a watch on the other wrist. However, if for some reason you cannot wear the accelerometer on the wrist of the hand that you use to write, then please wear it on the other wrist. The heart-beat symbol should be on the inside of your wrist (i.e. facing towards you).

The accelerometer is robust and water-proof, and has been designed to be worn when working or sleeping, having a bath or shower, or playing all types of sport (including swimming). Extremes of temperature may damage the battery so it should be taken off while you have a sauna.

3. Setting up the devices.

Now collect your devices from Hang, who will go through the accelerometer set-up with you.

You should have been given 1 wearable camera (Vicon Autographer), 1 wrist-worn accelerometer (and 1 micro-USB cable). For the Mac users, you can use the Open Movement website to try setup but it might not always work. For the Windows users, you can download OMGUI and follow the instructions in the `practicals/prac1-deviceSetup/accSetup.pdf` . Note that you should pay attention to several key parameters which might be different from the setup manual:

1. Change the sampling frequency to 30Hz.
2. Change the start date to today.
3. Leave the rest to the default settings.

Accelerometer

On a Mac, using the https://config.openmovement.dev/ setup page, set the sampling rate to 100 Hz, the range to +/- 8 g and the start time for immediately in the next few moments. You can set the duration for a specific number of hours, or leave the duration at the default 168 hours to ensure you are recording acceleration from the accelerometer for the entire time you are wearing the wearable camera. This web interface sometimes does not work. If that is the case, try someone else's computer, or Scott or Hang will help you set up on their machine. The local time of the accelerometer will be synced to the machine you set it up on.

Camera

software requirements

This week, you will use our group's wearable camera browser. Here are the steps, including the installation of Node.js, to get up and running with it.
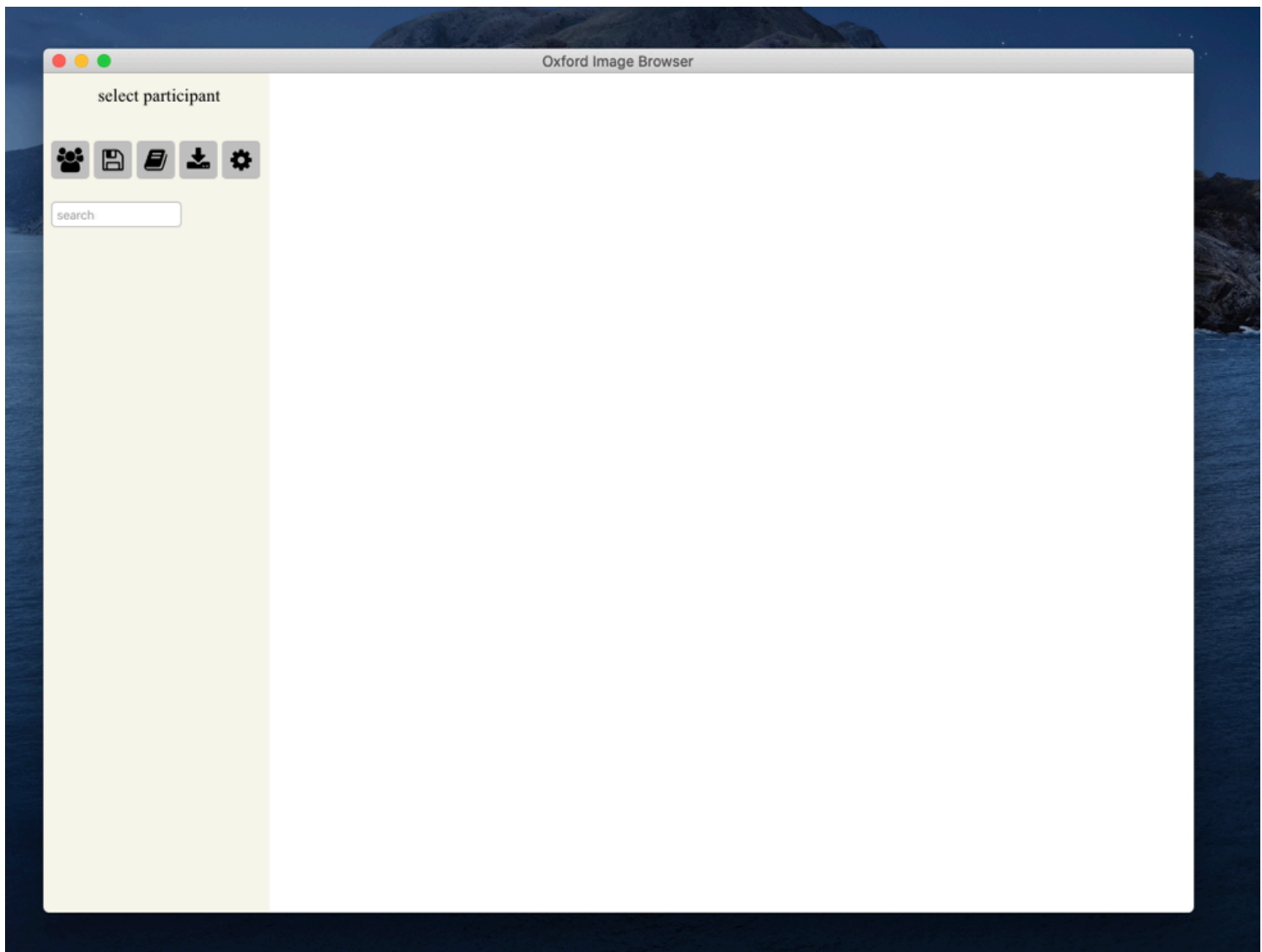
```
# 1. Download/clone this git repo
$ cd ~/Development/
$ git clone https://github.com/activityMonitoring/oxford-wearable-camera-browser.git

# 2. Install nodeJS
$ brew install node

# 3. Install npm package dependencies
$ npm install

# 4. Open/run browser
$ npm start
```

- Once it has been loaded properly you should see a window like this

- Hover your cursor over the different icons to familiarise yourself with the available functions.

camera setup

To set up the camera, you will run a script to ensure the camera has a correct local time and that it does not contain any past data. The time syncing step is important for you to correctly align the accelerometer and camera data.

The time syncing is based on your Mac's local time - so it is expected to be in UK time and not to deviate too much from the time on Hang's computer. You should also run the script as soon as your camera is plugged in to minimise any time lag.

Open your terminal and run these commands to set up your camera:

- Within the oxford-wearable-camera-browser directory, navigate to the `utilities` folder. We will use the script `autographer.py` located inside this folder - see here for more instructions if needed.

- take a moment to install the a Python package `tqdm` that we will need today. You're also expected to use Python 3.6. Open Terminal and run:

```
$ cd ~/Development/oxford-wearable-camera-browser/utilities/
$ pip3 install tqdm
```

- Plug in your camera to your Mac

- **IMPORTANT: Run this immediately after the camera is plugged in**

```
$ python3 autographer.py --setTime True
```

- You can now safely unplug the device.

Camera operating instructions

Action	Description
Turn on / off	Press the "ACTION" button to the side of the device for a few seconds. The screen will say 'hello'/ 'goodbye'.
Camera Status	Press the "MENU" button for an update on the battery status, number of pictures taken, and amount of memory space used.

Turn the camera on, and check that only the screen below shows when pressing the 'Menus' button:

Your camera should be fully charged at the start of this practical, but we recommend you check the battery percentage by pressing the MENU button. If the battery percentage becomes low during your data collection, please charge the camera with a micro-USB cable.

4. Collecting your own data in-the-wild

Now that you've set up the devices, you can go ahead with your day as normal to collect data! Please wear your devices for two days until Practical 3, when you will begin analysis and visualisation of your very own data!

Handin

See the bolded **"Handin:"** parts above. On paper or verbally, show a practical demonstrator your response to these to get signed off.