[TO BE DEFINED]

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Abstract—This is a sample abstract, just to show as an abstract should be. It is 204 words long, I would say an abstract should not be longer than 250 words. Here, you should briefly state: 1) technical scenario and its importance, 2) what you do in the report / paper and why it is important, 3) if possible, summarize the main results. The abstract should be written in a way that motivates the reader to delve into the paper, but at the same time it should contain enough information to deliver the main message about the paper, so that the reader will now what can be found within the paper even without reading it (as it is the case most of the times). The abstract is a mini-paper on its own and, as such, is a major endeavor to write.

Index Terms—Human Activity Recognition, Machine Learning, Neural Networks, Motion Detection.

I. Introduction

Maximum length for the whole report is 9 pages. Abstract, introduction and related works should take max two pages.

During the past decade, time series classification has captured growing interest thanks to the introduction of deep learning techniques, such as neural networks. These tools indeed are capable of identify and learn signal features, which are then exploited for classification, without the need of human domain-knowledge: this is a huge step forward considering that features were traditionally hand-crafted.[] Human Activity Recognition (HAR) in particular has been fostered by the spread of powerful, efficient and affordable sensors, which nowadays are commonly found in mobile phones and wearable devices, with multiple applications, ranging from health care to gaming and virtual reality. [1] Wearable sensors allow us to collect and process a huge amount of signals, which are essential for deep neural networks (DNN) to work properly: in fact, in order for them to learn and being accurate enough to be preferred over standard machine learning approaches, we need the input training set to be heterogeneous, meaningful and representative of the problem. For this reason, HAR is not an easy classification problem: when dealing with on-body sensors, system performances heavily depends on human behaviour, since it is a source of high variability; moreover, data collected from sensors is typically high-dimensional, multi-modal and subjected to noise, making the problem even more difficult from a machine learning perspective. In the recent years, several models to perform activity detection and classification have been proposed [], but as pointed out in

[2] and [], the lack of a baseline evaluation setup and of implementation details prevented a fair comparison between them.

A good way of structuring the introduction is as follows:

- one paragraph to introduce your work, describing the scenario at large, its relevance, to prepare the reader to what follows and convince her/him that the paper focuses on an important setup / problem.
- a second paragraph where you immediately delve into the specific problem that is still to be faced, starting to point the finger towards your contribution. Here, you describe the importance of such problem, providing examples (through references) of previous solutions attempts, and of why these failed to provide a complete answer. This second paragraph should not be too long, as otherwise the reader will get bored and will abandon your paper... It should be concisely written, something like 4 to 5 lines.
- a third paragraph were you state what you do in the paper, this should also be concisely written and to the point. A good rule of thumb is to make it max 10 lines. Here, you should state up front 1) the problem you solve, 2) its importance, 3) the technique you use, 4) stress the novelty of such technique / what you do. 5) comment on how your work / results can be reused / exploited to achieve further technical or practical goals.
- after this, you provide an itemized list to summarize the paper contributions: maximum six items, maximum four lines each.
- you finish up by reporting the paper structure, this should be three to four lines. It is customary to do so, although I admit it may be of little use.

Lately, I tend to write introduction plus abstract within a single page. This forces me to focus on the important messages that I want to deliver about the paper, leaving out all the blah blah. Remember: 1) less is more, 2) writing a compact (snappy) piece of technical text is much more difficult than writing with no space constraints.

II. Related Work

The goal of this section is to describe what has been done so far in the literature. You should focus on and briefly describe the work done in the best papers that you have read. For each you should comment on the paper's contribution, on the good and important findings of such paper and also, 1) on why these findings are not enough and 2) how these findings are improved upon / extended

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by the work that you do here. At the end of the section, you recap the main paper contributions (one or two, the most important ones) and how these extend / improve upon previous work. If possible, I would make this section no longer than one page, this leads to an overall two pages including abstract, introduction and related work. I believe this is a fair amount of space in most cases.

- References: please follow this religiously. It will help you a lot. Use bibtex as the tool to manage the bibliography. A bibtex example file, maned biblio.bib is also provided with this package.
- When referring to conference / workshop papers, I recommend to always include the following information: 1) author names, 2) paper title, 3) conference / workshop name, 4) conference / workshop address, 5) month, 6) year. Examples of this are: [3] [4].
- When referring to journal papers, include the following information: 1) author names, 2) paper title, 3) full journal name, 4) volume, 5) number, 6) month, 7) pages, 8) year. Examples of this are: [5] [6] [7].
- For books, include the following information: 1) author names, 2) book title, 3) editor and edition, 4) year.

Note that some of the above fields may not be shown when you compile the Latex file, but this depends on the bibliography settings (dictated by the specific Latex style that you load at the beginning of the document). You may decide to include additional pieces of information in a given bibliographic entry, but please, be consistent across all the entries, i.e., use the same fields. Exceptions are in the (rare) cases where some of the fields do not exist (e.g., the paper number or the pages).

III. Processing Pipeline

I would start the technical description with a high level introduction of your processing pipeline. Here you do not have to necessarily go into the technical details of every processing block, this will be done later as the paper develops. What I would like to see here is a description of the general approach, i.e., which processing blocks you used, how these were concatenated, etc. A diagram usually helps.

IV. Signals and Features

Being a machine learning paper, I would put here a section describing the signals you have been working on. If possible, you should describe, in order, 1) the measurement setup, 2) how the signals were pre-processed (to remove noise, artifacts, fill gaps or represent them through a constant sampling rate, etc.). After this, you should describe how feature vectors were obtained from the pre-processed signals. If signals are time series this also implies stating the segmentation / windowing strategy that was adopted, to then describe how you obtained a feature vector for each time window. Also, if you also experiment with previous feature extraction approaches, you may want to list them as well, in addition to (and before) your own (possibly new) proposal.

V. Learning Framework

Here you finally describe the learning strategy / algorithm that you conceived and used to solve the problem at stake. A good diagram to exemplify how learning is carried out is often very useful. In this section, you should describe the learning model, its parameters, any optimization over a given parameter set, etc. You can organize this section in sub-sections. You are free to choose the most appropriate structure.

VI. Results

In this section, you should provide the numerical results. You are free to decide the structure of this section. As general rules of thumb, use plots to describe your results, showing, e.g., precision, recall and F-measure as a function of the system (learning) parameters. Present the material in a progressive and logical manner, starting with simple things and adding details and explaining more complex behaviors as you go. Also, do not try to explain / show multiple concepts at a time. Try to address one concept at a time, explain it properly, move to the next one.

The best results are obtained by generating the graphs in either encapsulated postscript (eps) or pdf formats. To plot your figures, use the includegraphics command.

VII. Concluding Remarks

This section should take max half a page.

In many papers, here you find a summary of what done. It is basically an abstract where instead of using the present tense you use the past participle, as you refer to something that you have already developed in the previous sections. While I did it myself in the past, I now find it rather useless.

What I would like to see here is: 1) a very short summary of what done, 2) some (possibly) intelligent observations on the relevance and applicability of your algorithms / findings, 3) what is still missing, and can be done in the future to extend your work. The idea is that this section should be useful and not just a repetition of the abstract (just re-phrased and written using a different tense...).

Moreover: being a project report, I would also like to see a specific paragraph specifying: 1) what you have learned, and 2) any difficulties you may have encountered.

References

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