We Rock the Hizzle and Stuff

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***Abstract*—Future vehicular communication networks call for new solutions to support their capacity demands, by leveraging the potential of the millimeter-wave (mm-wave) spectrum. Mobility, in particular, poses severe challenges in their design, and as such shall be accounted for. A key question in mm-wave vehicular networks is how to optimize the trade-off between directive Data Transmission (DT) and directional Beam Training (BT), which enables it. In this paper, learning tools are investigated to optimize this trade-off. In the proposed scenario, a Base Station (BS) uses BT to establish a mm-wave directive link towards a Mobile User (MU) moving along a road. To control the BT/DT trade-off, a Partially Observable (PO) Markov Decision Process (MDP) is formulated, where the system state corresponds to the position of the MU within the road link. The goal is to maximize the number of bits delivered by the BS to the MU over the communication session, under a power constraint. The resulting optimal policies reveal that adaptive BT/DT procedures significantly outperform common-sense heuristic schemes, and that specific mobility features, such as user position estimates, can be effectively used to enhance the overall system performance and optimize the available system resources.**
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*—Mm-Wave, Vehicular Networks, Optimization, Beam Training, Data Transmission, Partially Observable MDP.**
A list of keywords defining the tools and the scenario. I would not go beyond *six* keywords.

I. Introduction

GANs, namely Generative Adversarial Networks, are a hot topic nowadays. Since their first description in [] they have gained more and more momentum because they are able to sidestep some of the difficulties encountered when trying to apply deep learning to generative models: until then, deep learning has had indeed a greater impact on discriminative models, leaving less success to deep generative ones. The purpose of a generative model is, given a training set of sample data distributed according to an unknown probability density function (pdf) p_{data}, to generate samples with a distribution p_g that mimics p_{data}. (This can be done in several ways, e.g. implicitly or explicitly, â) [HOW] As suggested by the name, in GAN framework this is achieved by putting in competition two entities: a generator and a discriminator. The task of the generator (G) is to generate data that can be regarded as true by the discriminator, while the discriminator (D) has the purpose of correctly classifying real data and fake data. The classical real-life analogy with this process involves counterfeiters trying to produce fake currency and the police trying to detect it. Usually these two entities are implemented with neural networks, so that the process by which they learn is of trial and error. However the GANs are difficult to train, because they present several implementation problems which lead to results that might be different from what expected. [GENERATIVE MODELS] [] Ideally then $p_g = p_{data}$, but since the latter is unknown the objective of the training should be defined in a slightly different way.

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Special thanks / acknowledgement go here.

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 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: [**?**] [**?**].
- 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: [**?**] [**?**] [**?**].
- 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