

Autonomous driving Scenarios Generation with GANs

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Autonomous vehicles need various data to ensure **safety**. This idea is one of the main objectives of project EPI, focused on **AI-based Decision Making Systems Performance Evaluation**. Nevertheless, it's practically impossible to gather all the situations that could occur on a road. In order to overstep this problem, one may **generate scenarios automatically**.

- Adapt scenarios representation to the use of **Generative Adversarial Networks (GANs)**
- Train several GANs and Wasserstein GANs to maximize driving situations coverage

Data processing

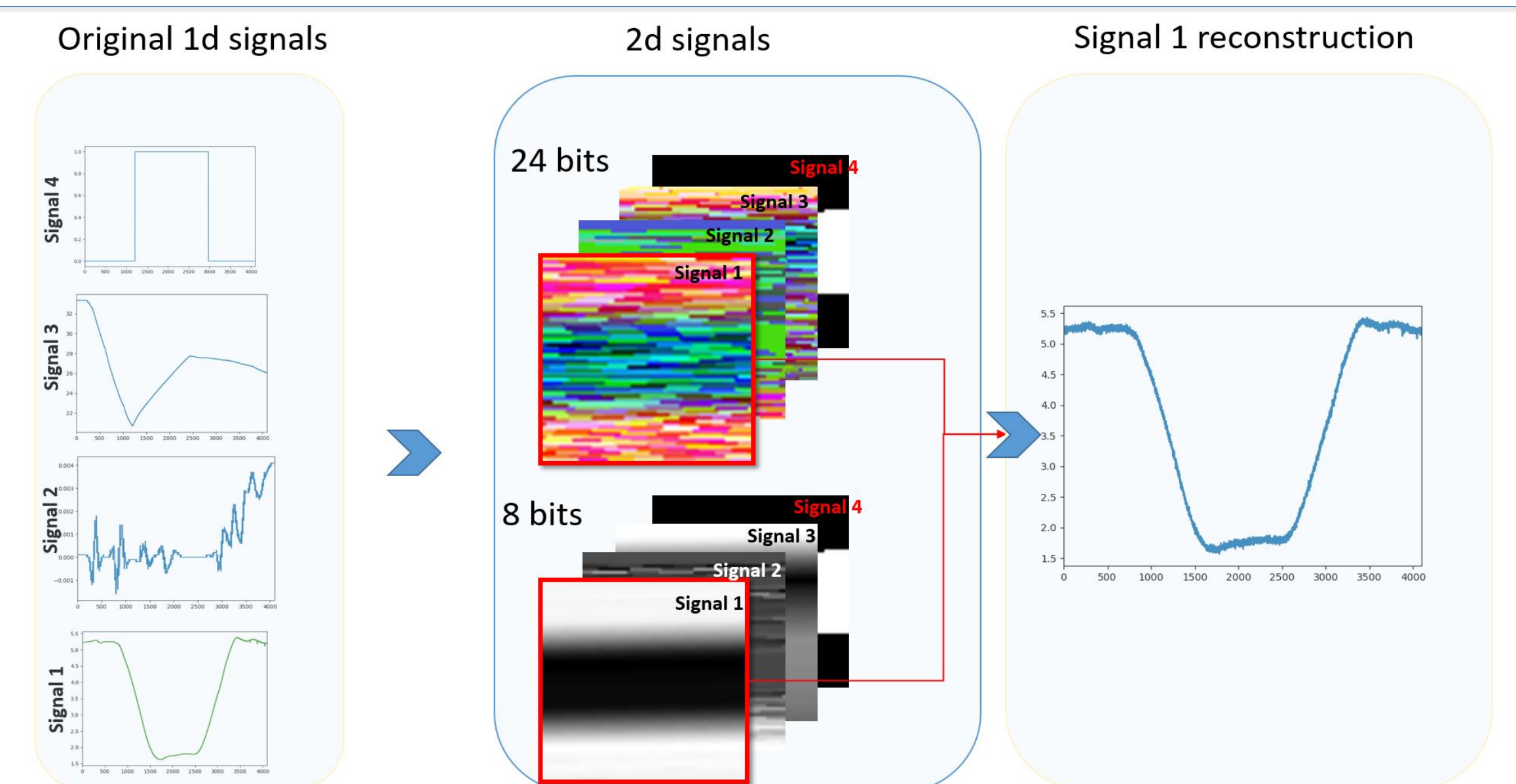
Our scenarios are composed of several univariate time series.

Our scenarios are collected from a simulator designed by Groupe PSA.

A driving scenario can be turned into an image by:

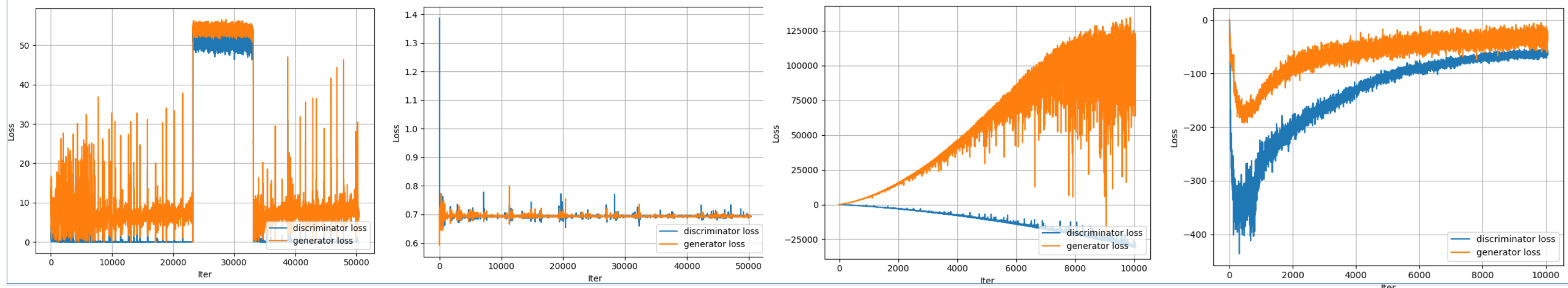
- Turning each univariate serie into a **RGB image**
- **Concatenating** them to form an image

After training, generated series need to be denoised using a Fast Fourier Transform.

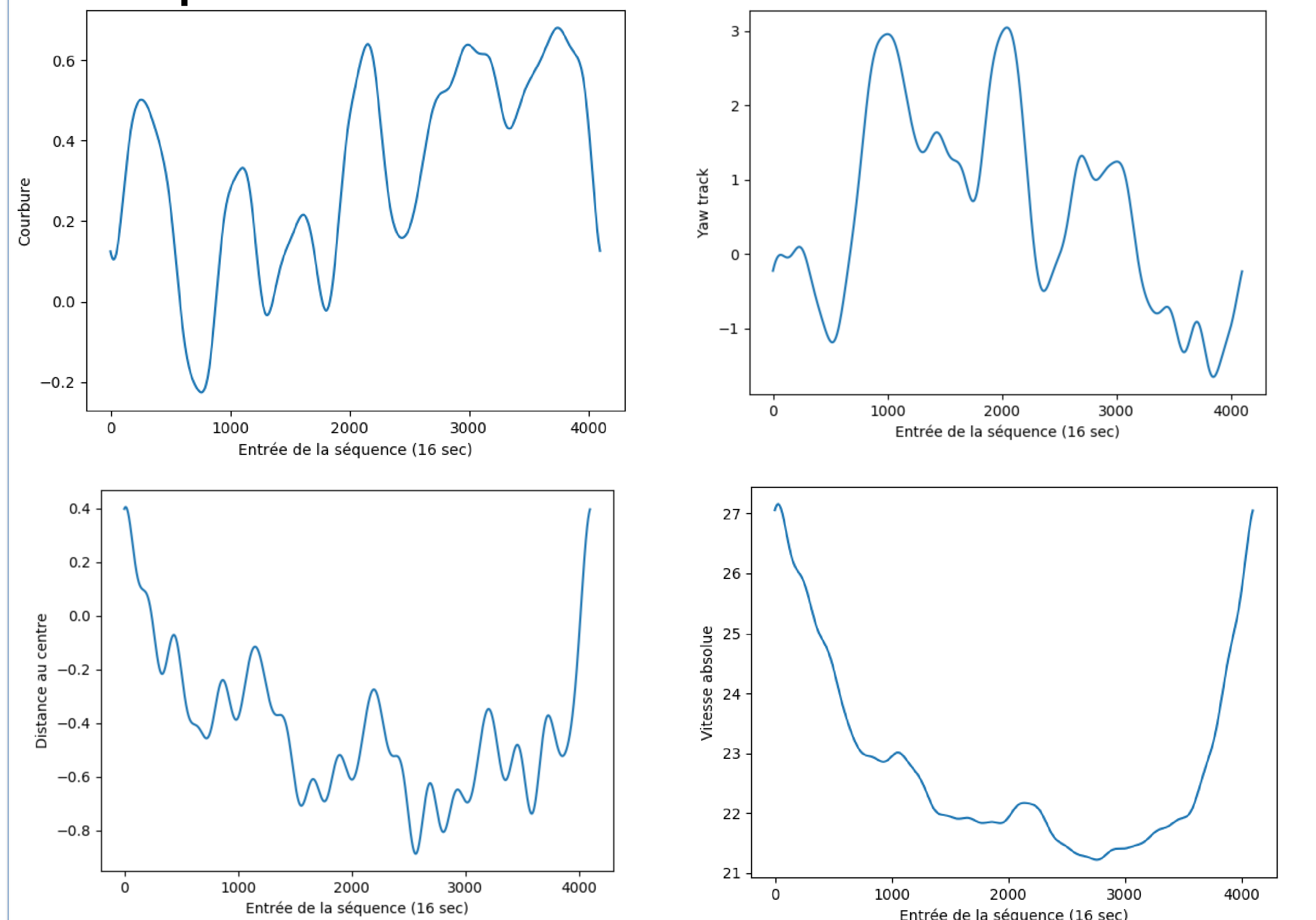


Learning curves from vanilla GAN/WGAN to normalized ones (108 models on 5357 scenarios)

Spectral normalization stabilizes models convergence, while making it faster. In terms of scenarios generation, it reaches the same results as regularized models with a less computational cost.



Exemple of a Generated scenario



Conclusion

- **Realistic generated scenarios**
- Regularization and normalization matter more than the choice of a cost function
- No real correlation between Wasserstein loss (WGAN) and generation quality
- Described the learning dynamics of GANs, through an empirical study involving an image representation of time series