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Open Denoising:
An Open Benchmark for Image Denoising Methods

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Summary:

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Introduction

Why do we need a benchmark?

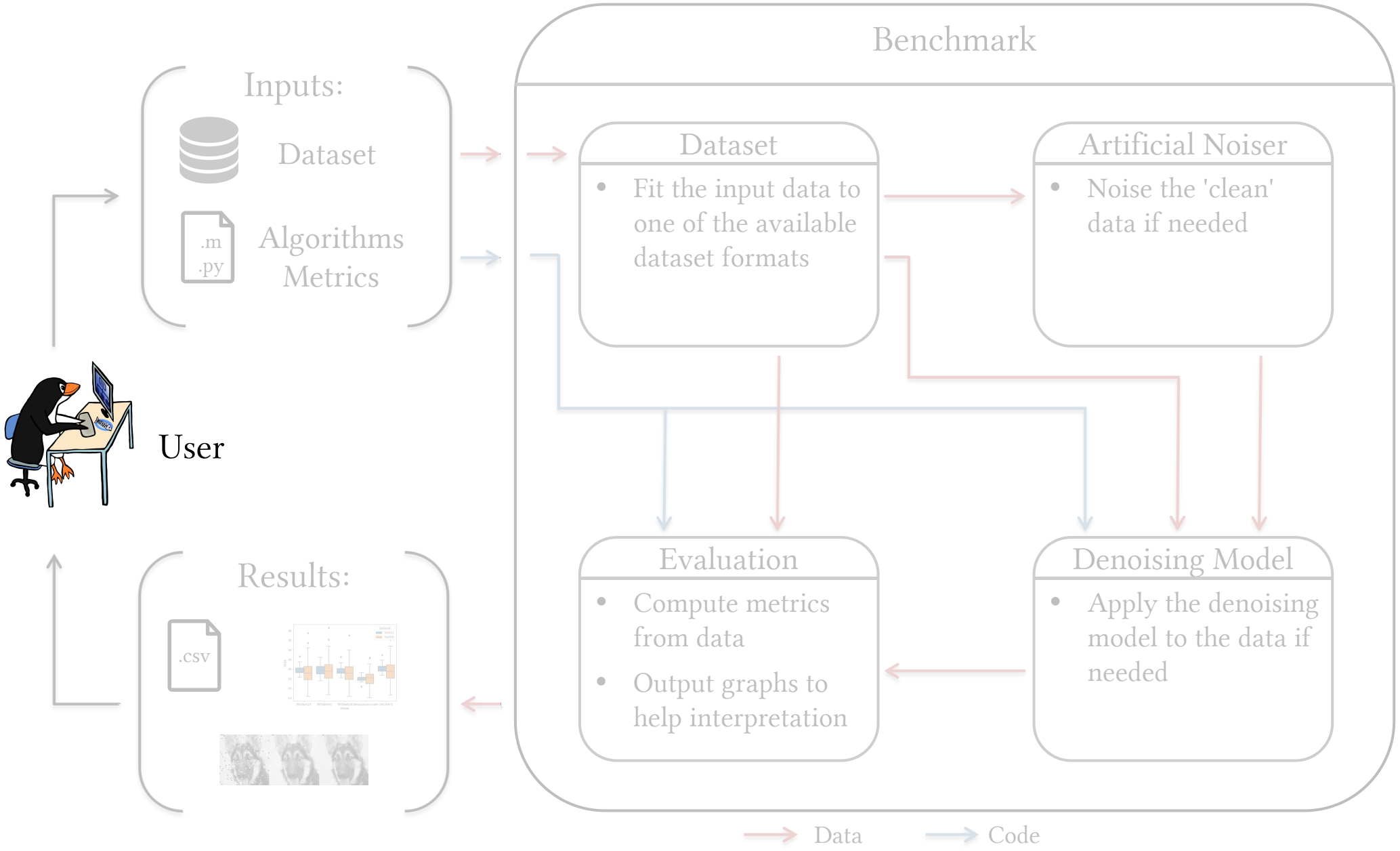
- A simple research on Google Scholar gives : 2700+ results for “image denoising”, 200+ for “video denoising”
  - Impossible to re-implement all methods to evaluate/compare
  - How to compare and situate a method in the state-of-the-art?
- Hence, the need for a comparison method --> a benchmark

Related Work

Existing solutions & their features:

Benchmark	Open-source	Methods	Language	Data	Dataset	Image Type	Evaluation Metric
GitHub/lbasek/image-denoising-benchmark [1]	×	Non-Statistical	Matlab	Images	RENOIR [2]	Natural	PSNR SSIM MSE Run-Time
Darmstadt Benchmark [3]		Any	Any	Images	Darmstadt Noise [3]	Natural	PSNR SSIM
Open Denoising (Our)	×	Any	Python Matlab	Images Videos	Any	Any	Any

Architecture



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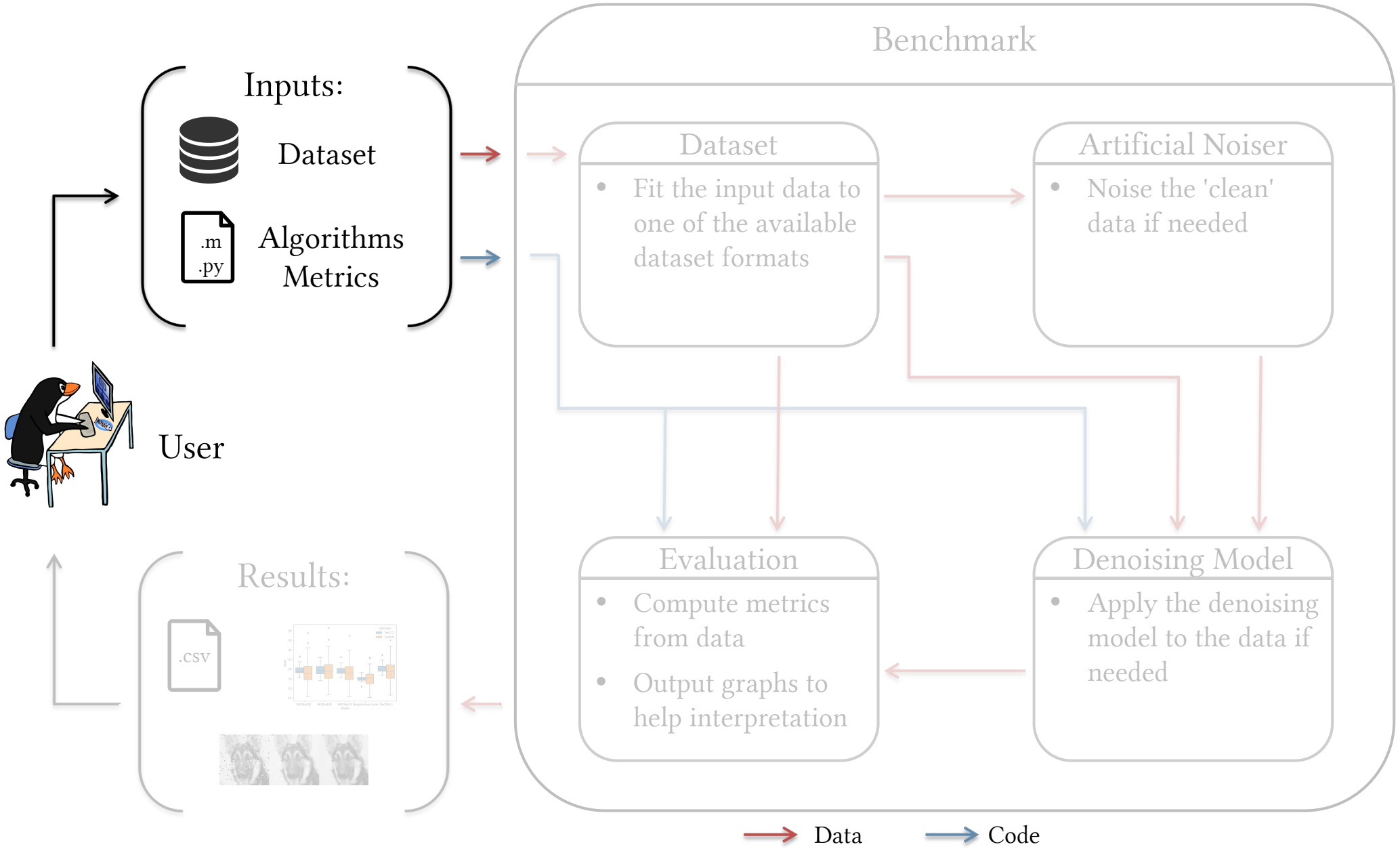

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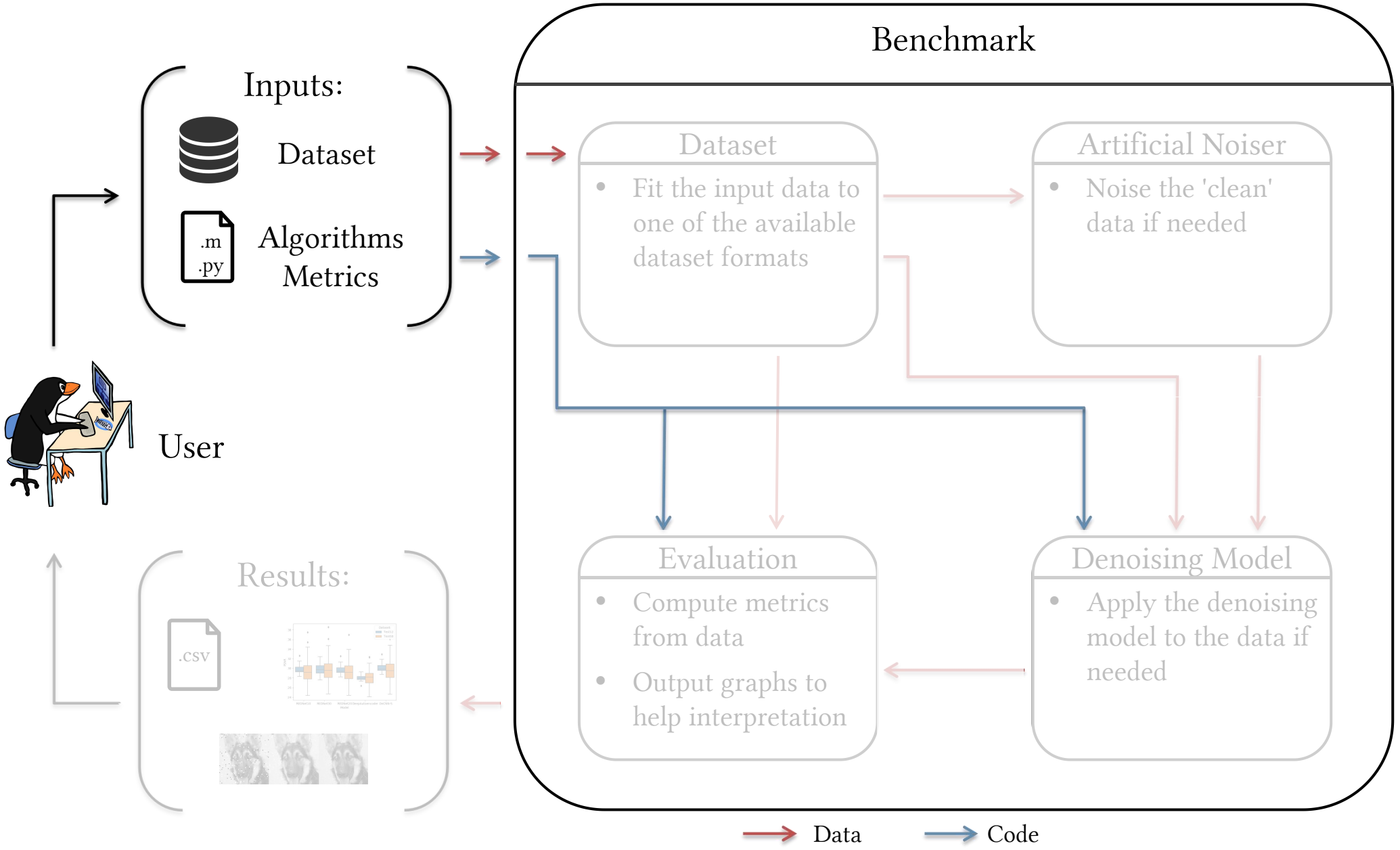

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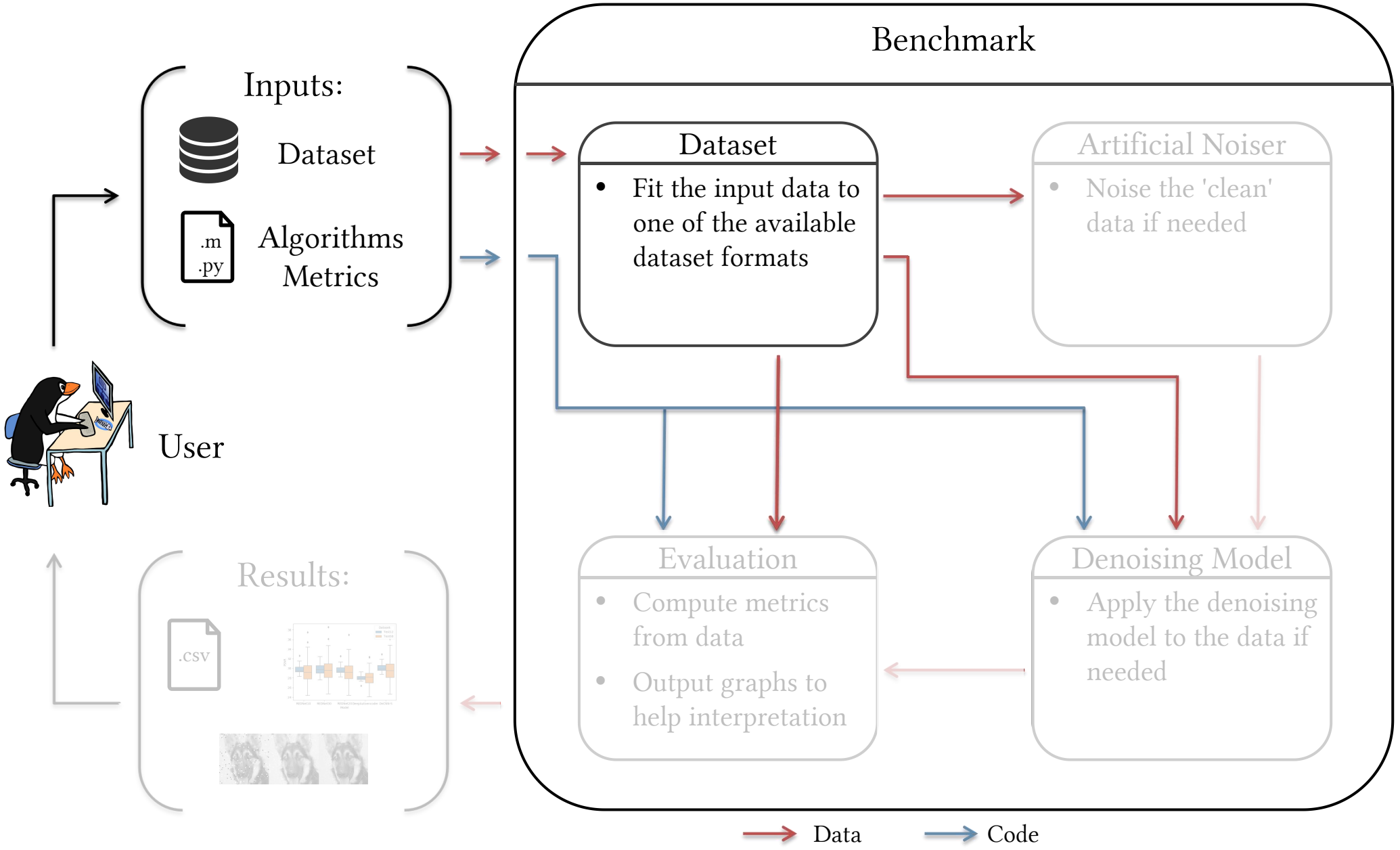

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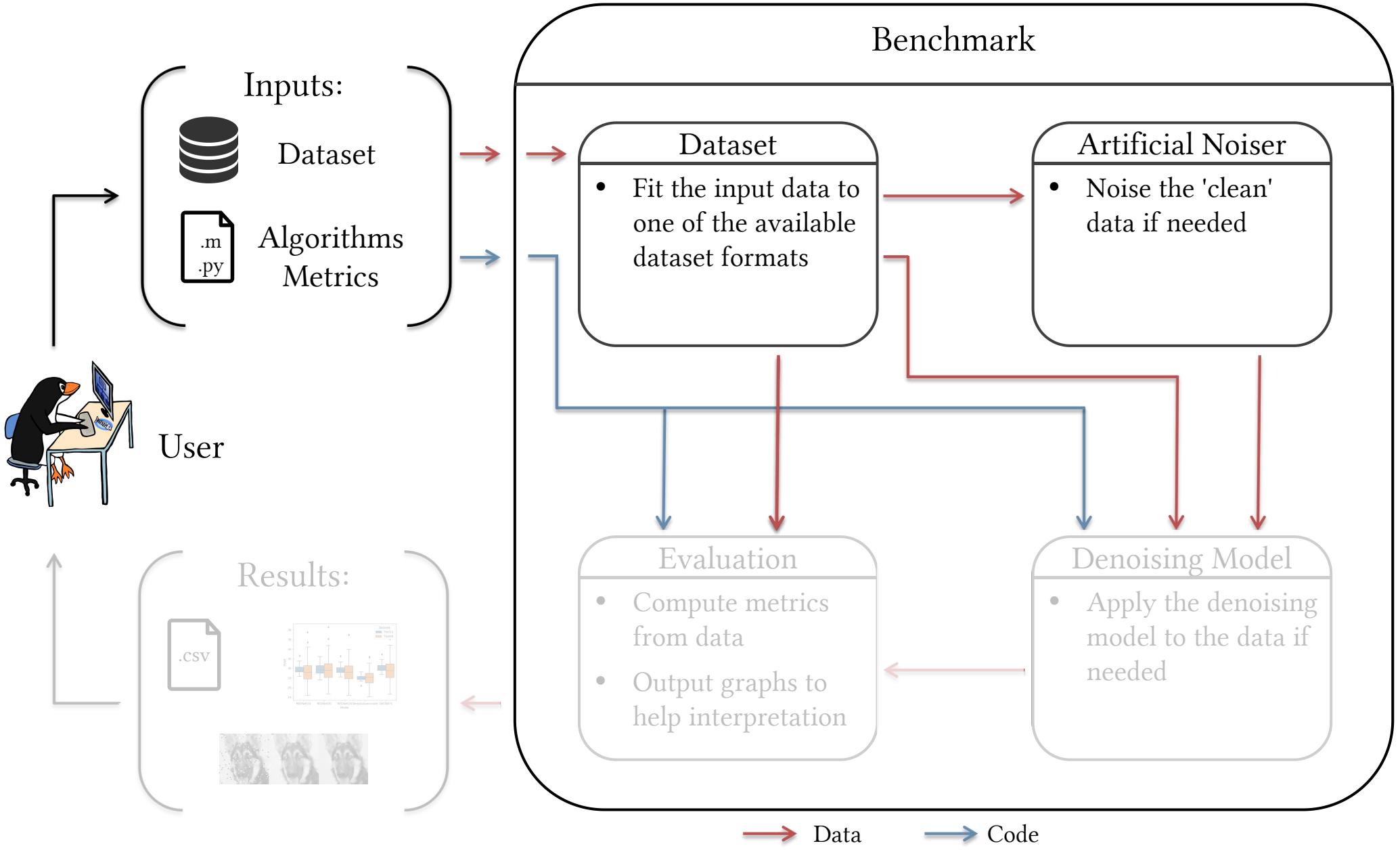

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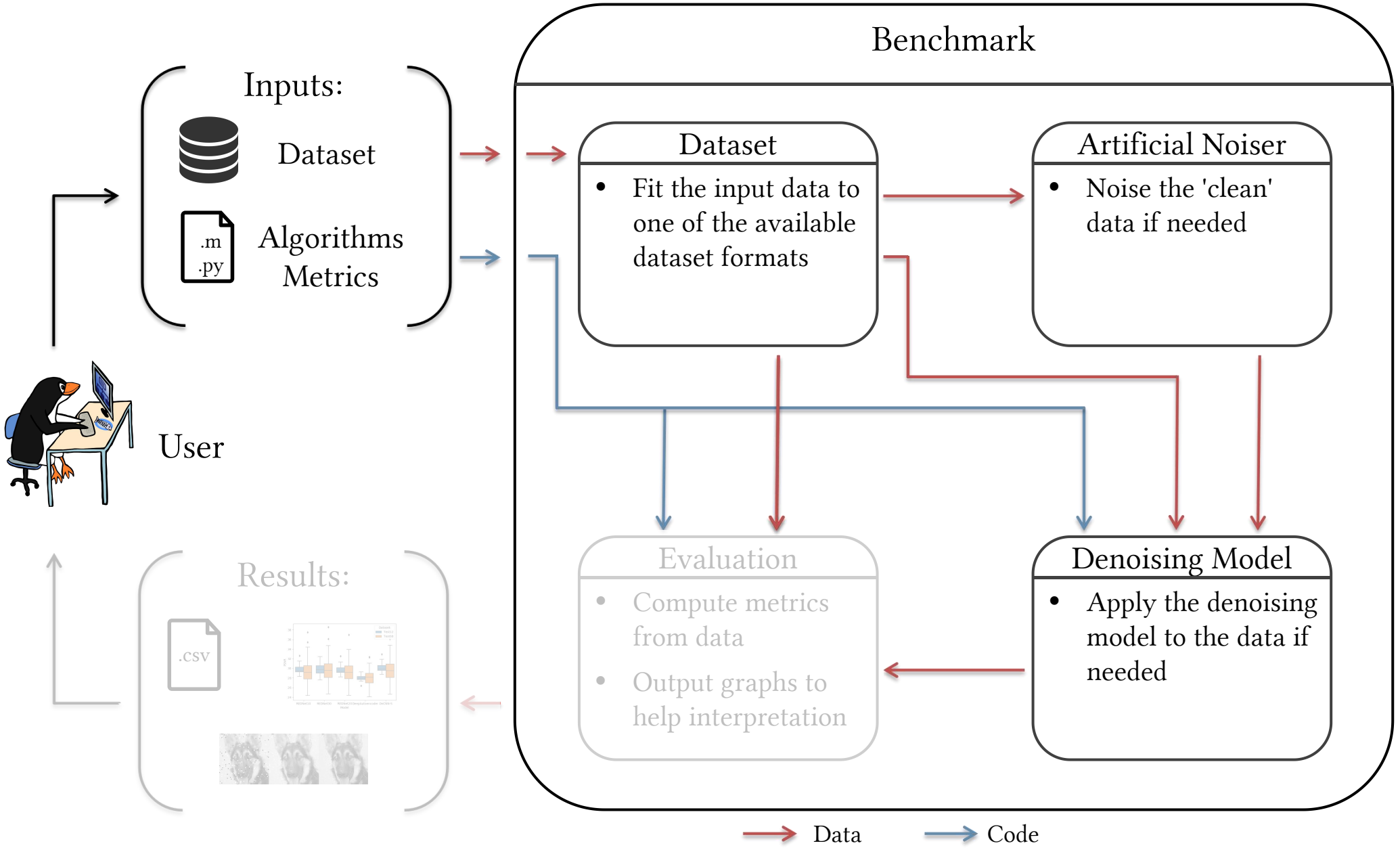

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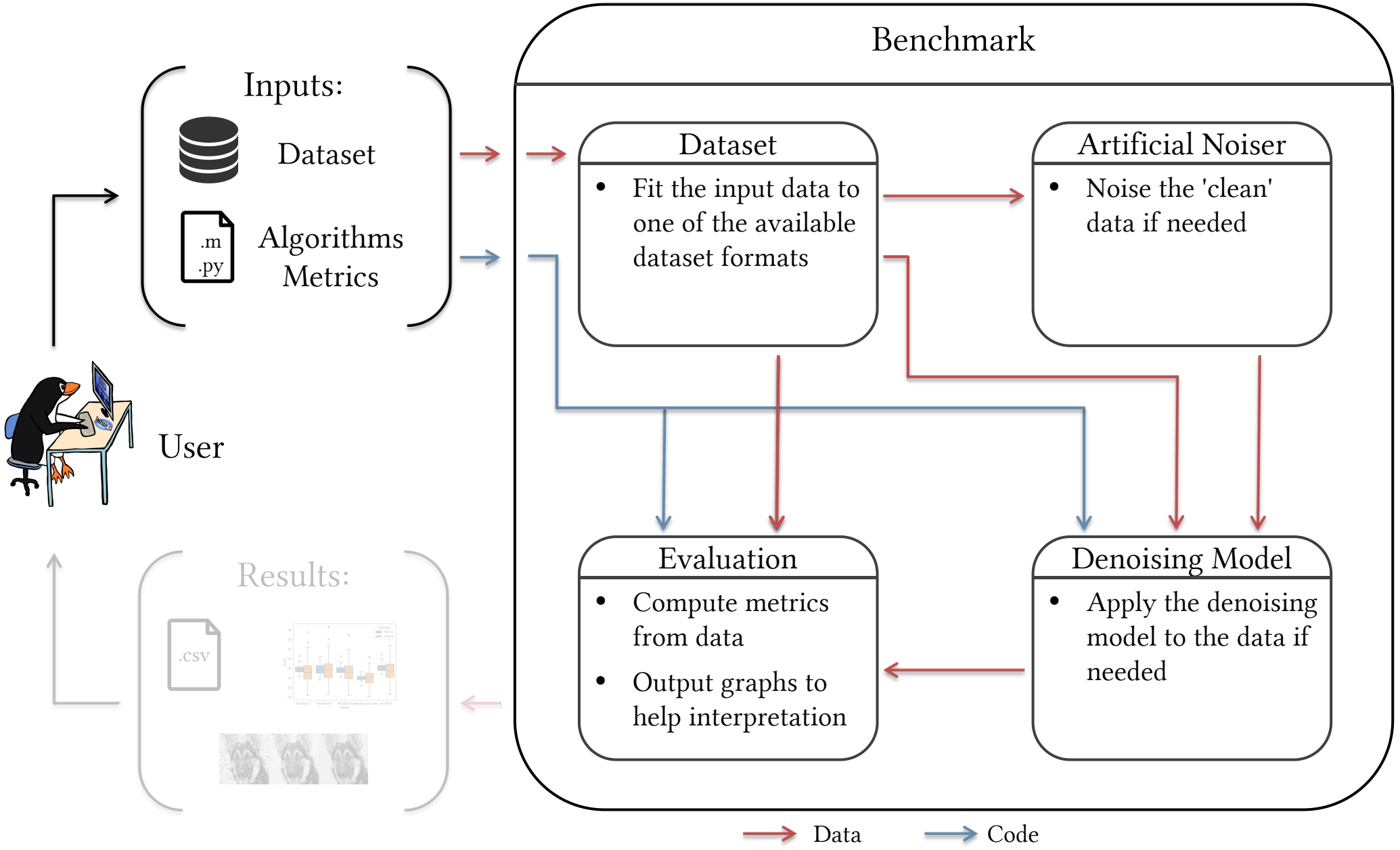

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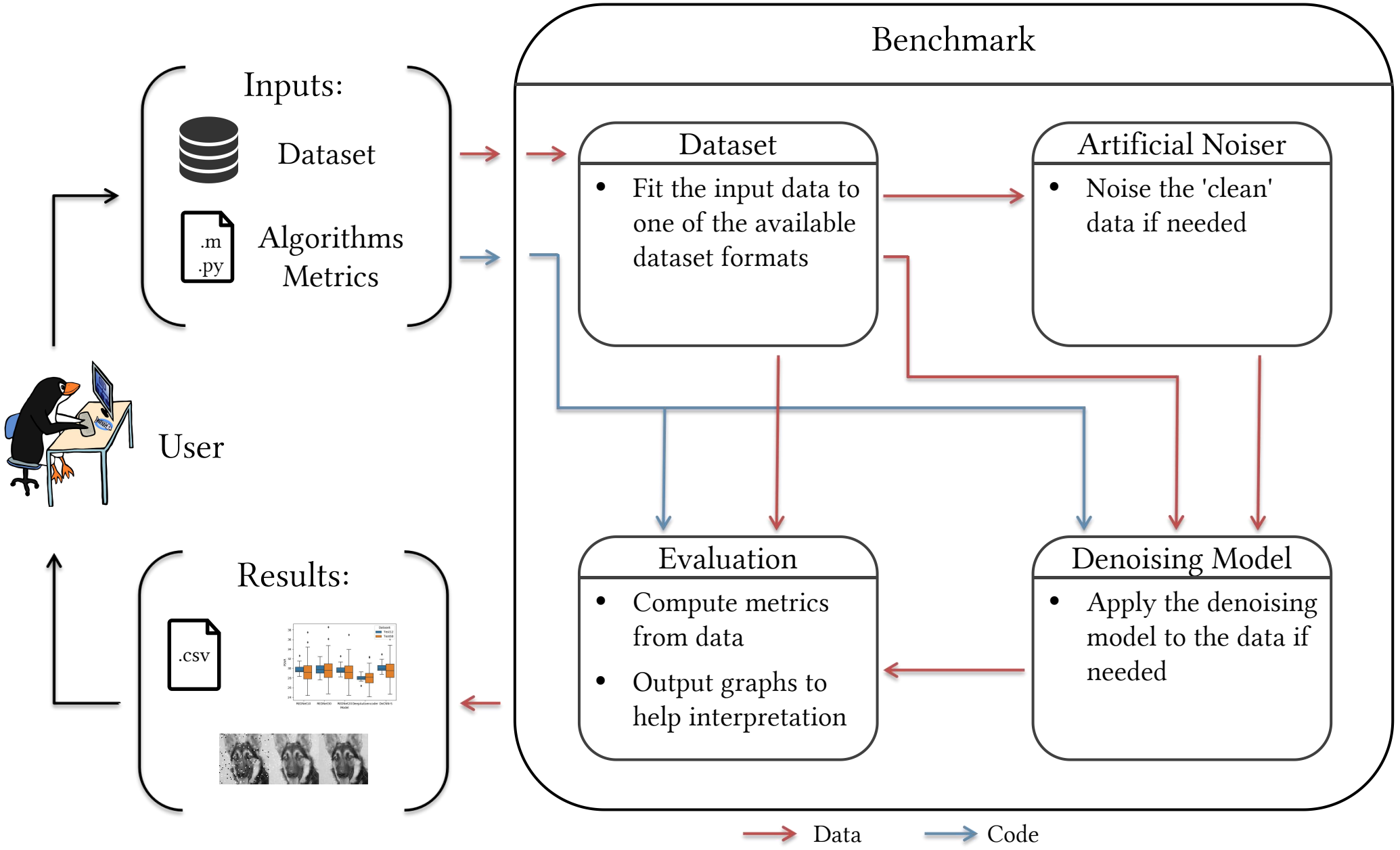


Architecture - Details

Dataset

- Fit the input data to one of the available dataset formats

→ 4 cases :
- clean/noisy samples
- noisy/denoised samples (for evaluation only)
- only noisy samples (for blind denoising)
- only clean samples (to be noised)

Artificial Noiser

- Noise the "clean" data if needed

→ Typical noises already implemented : gaussian, salt & pepper,...

Denoising Model

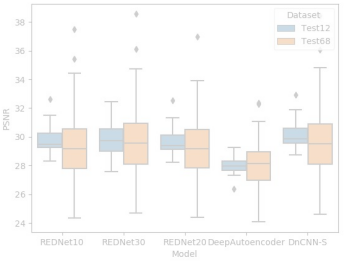
- Apply the denoising model(s) to the data if needed

→ Can be native-Python, Matlab, Tensorflow, Keras code/model
Several state-of-the-art models implemented (DnCNN [4], GCBD [5], ...)

Evaluation

- Compute metrics
- Output graphs to help interpretation

→ Supports user defined metrics
Graphs/image samples
Full report exported in csv file



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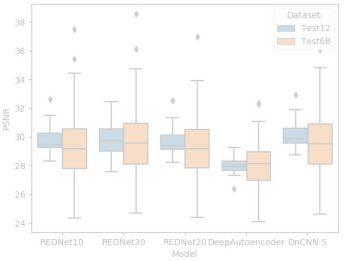

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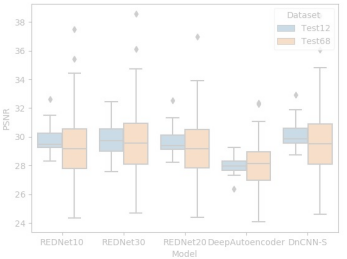

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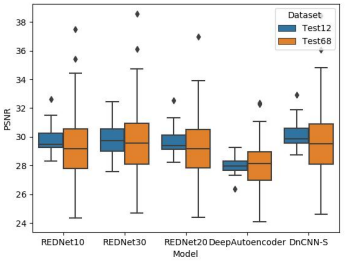

Conclusion

Summary

- There is a need for an image an video denoising benchmark
- We propose a fully tunable benchmark for image and video denoising
  - User can choose: dataset, algorithms, evaluation metrics
- Application to be released soon on Github

Future Work

- Features to be implemented :
  - Graphical User Interface
  - Support for other languages (C++, ...)
  - Support for other frameworks (Pytorch, Theano, ...)

References:

[1] https://github.com/lbasek/image-denoising-benchmark

[2] Anaya, J., & Barbu, A. (2018). RENOIR–A dataset for real low-light image noise reduction. Journal of Visual Communication and Image Representation, 51, 144-154.

[3] Plotz, T., & Roth, S. (2017). Benchmarking denoising algorithms with real photographs. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 1586-1595).

[4] K. Zhang, W. Zuo, Y. Chen, D. Meng, et L. Zhang, « Beyond a Gaussian Denoiser: Residual Learning of Deep CNN for Image Denoising », IEEE Transactions on Image Processing, vol. 26, n° 7, p. 3142-3155, 2017.

[5] J. Chen, H. Chao, et M. Yang, « Image Blind Denoising with Generative Adversarial Network Based Noise Modeling », in 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition, Salt Lake City, UT, 2018, p. 3155-3164.

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[3] Plotz T. et Al. (2017), « Benchmarking denoising algorithms with real photographs», CVPR17

[4] Zhang K. et Al. (2017), « Beyond a Gaussian Denoiser: Residual Learning of Deep CNN for Image Denoising », IEEE Transactions on Image Processing

[5] Chen J. et Al. , (2018), « Image Blind Denoising with Generative Adversarial Network Based Noise Modeling », CVPR18

Questions & Discussions

Thank you for your attention!

Do you have questions?

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