Rocket + MiniRocket

Berlin Time Series Analysis Meetup

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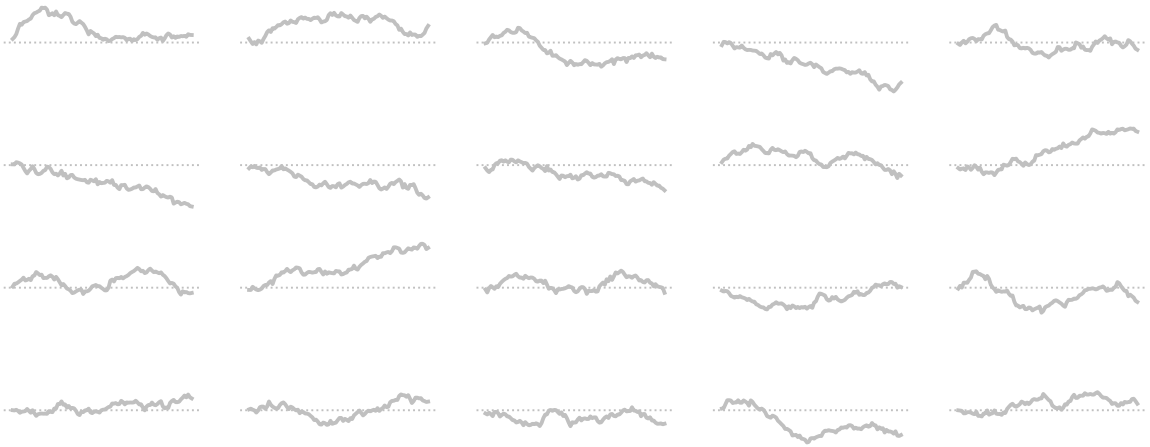
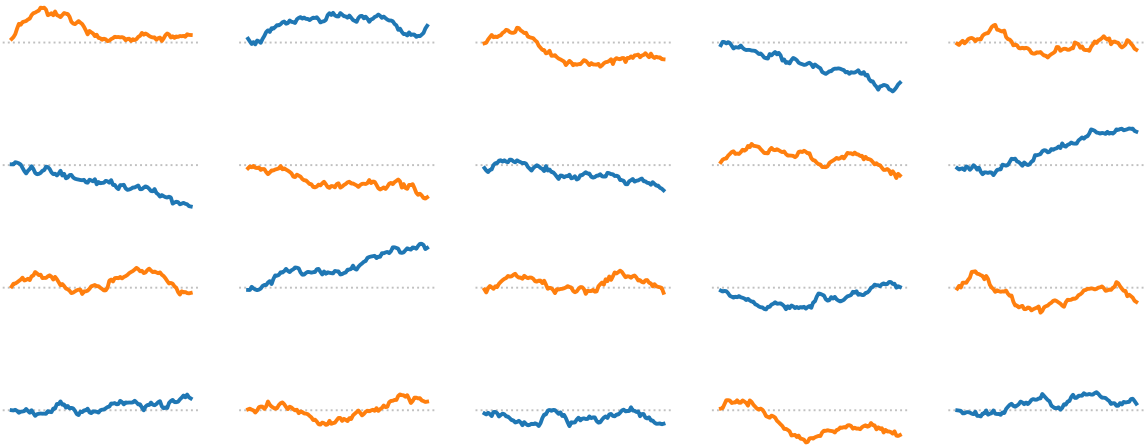
1. Background
2. Rocket
3. MiniRocket

Background





- recent advances in accuracy (TDE, CIF, . . .)
- high computational complexity + lack of scalability

- Rocket + MiniRocket $\longrightarrow$ SOTA w/o the computational expense

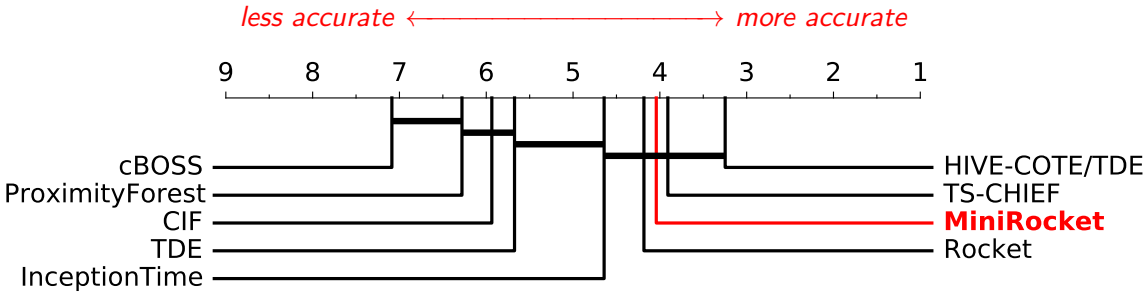
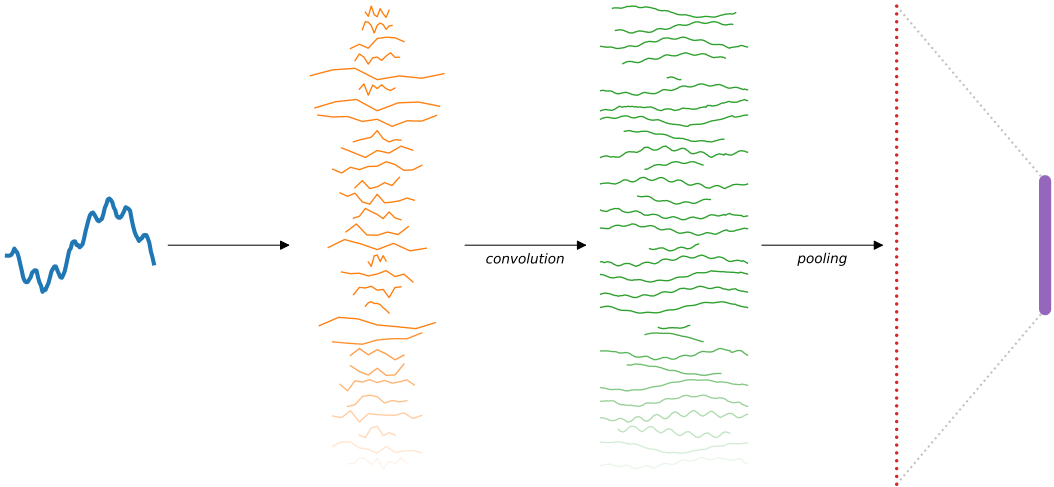


Figure: Mean rank, accuracy

8 minutes (MiniRocket) $\ll$ 2 hours (Rocket) $\ll$ days/weeks (others)

Rocket

Dempster A, Petitjean F, Webb GI (2020a) Rocket: Exceptionally Fast and Accurate Time Classification Using Random Convolutional Kernels. Data Mining and Knowledge Discovery 34(5):1454–1495

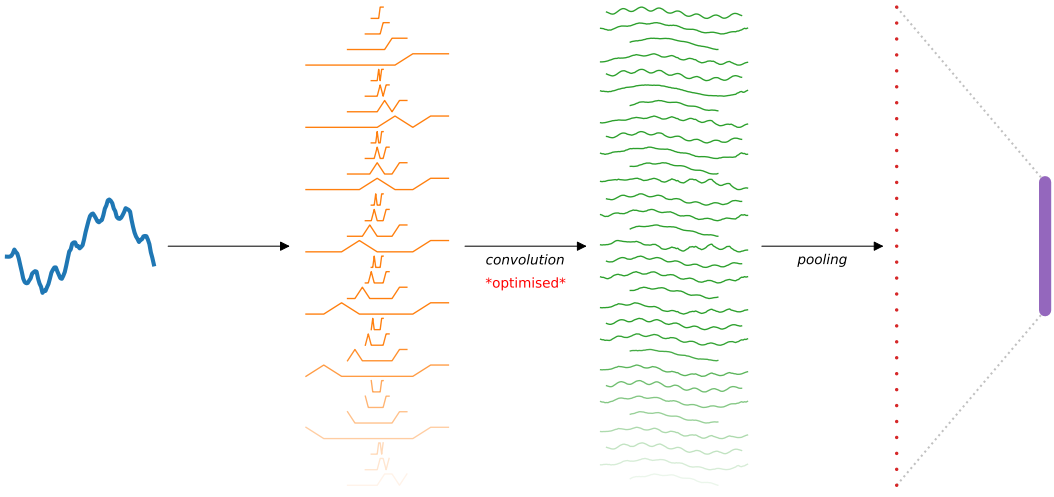

convolution
pooling
input (X)
kernel (W) & bias (b)
$X * W - b$
{max, ppv}

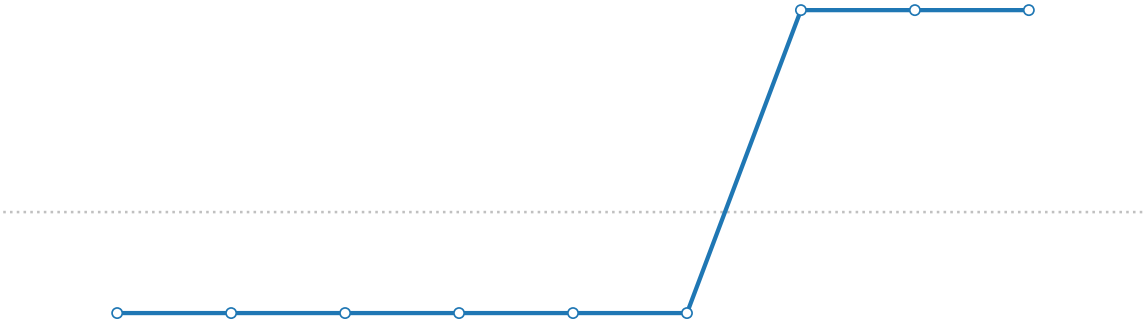
MiniRocket

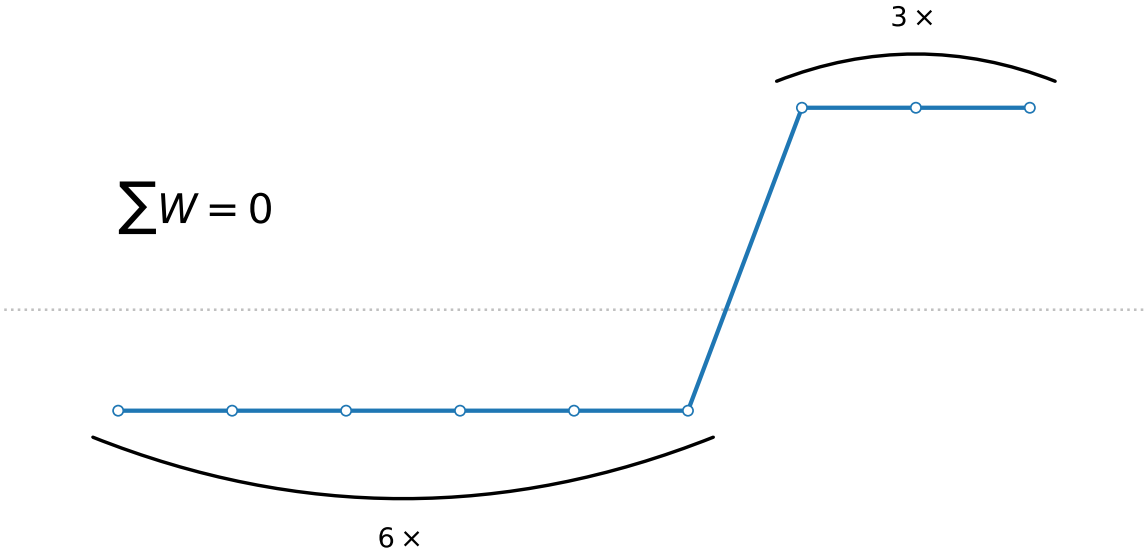
Dempster A, Schmidt DF, Webb GI (2020b) MiniRocket: A Very Fast (Almost) Deterministic Transform for Time Series Classification, arXiv:2012.08791

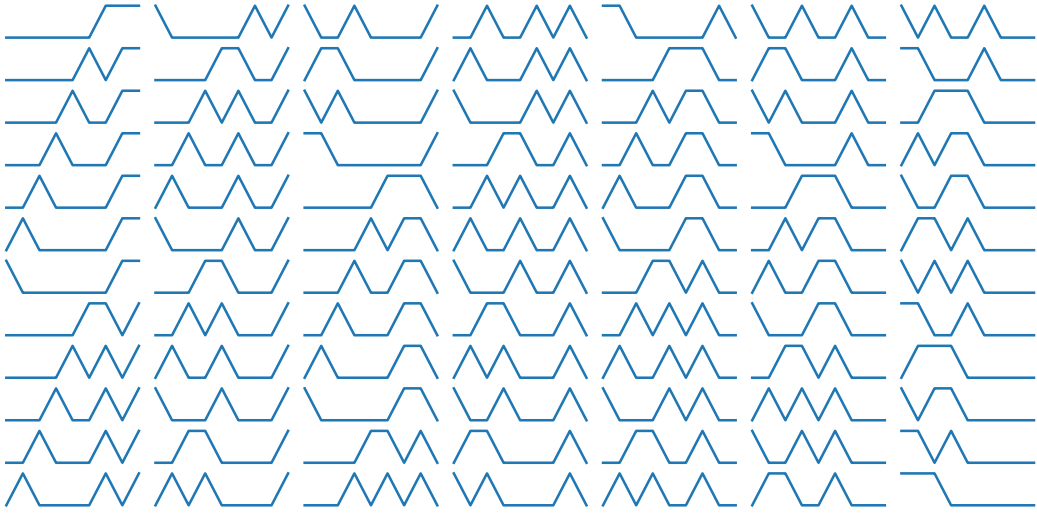
random $\longrightarrow$ (mostly) non-random

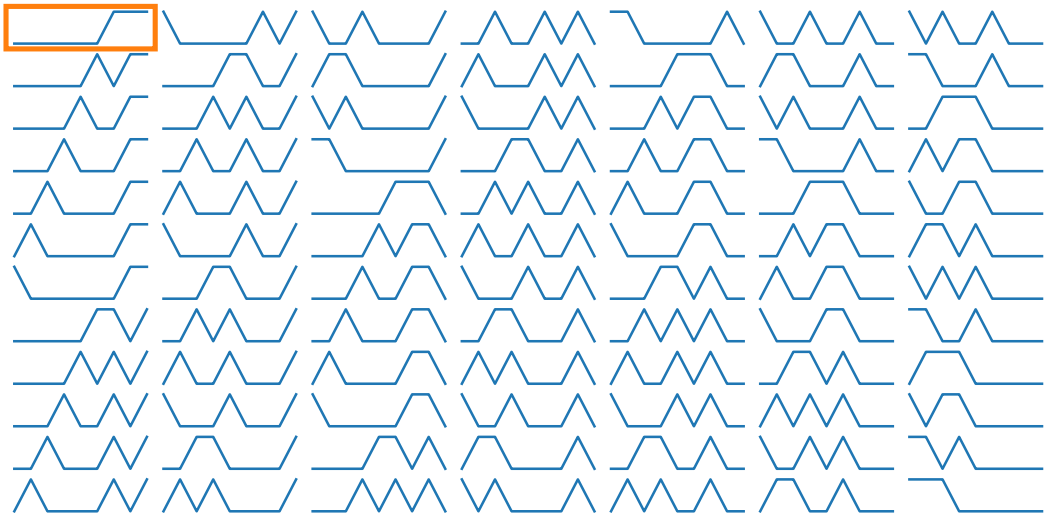
fast $\longrightarrow$ much faster ($75\times$)

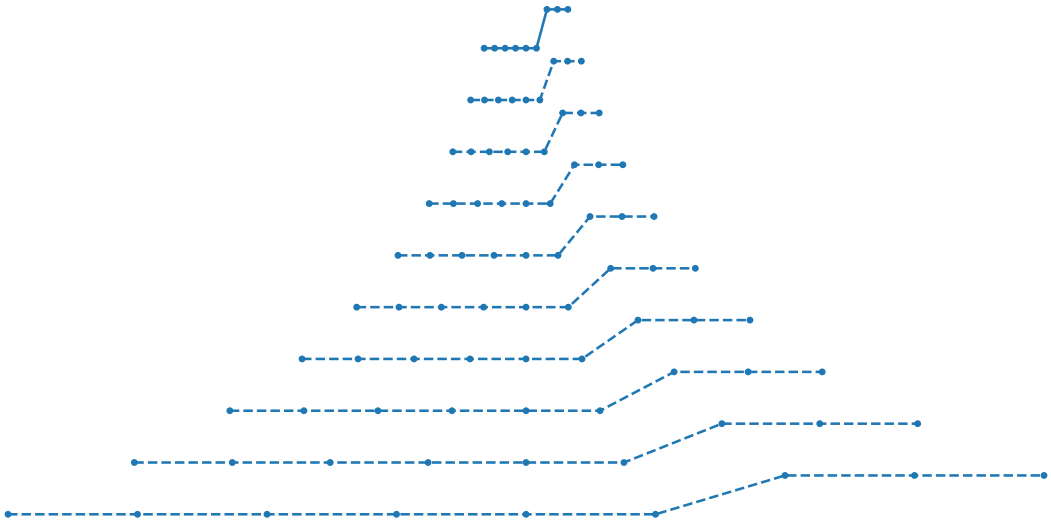

convolution
optimised
pooling
input (X)
kernel (W) & bias (b)
$X * W - b$
ppv

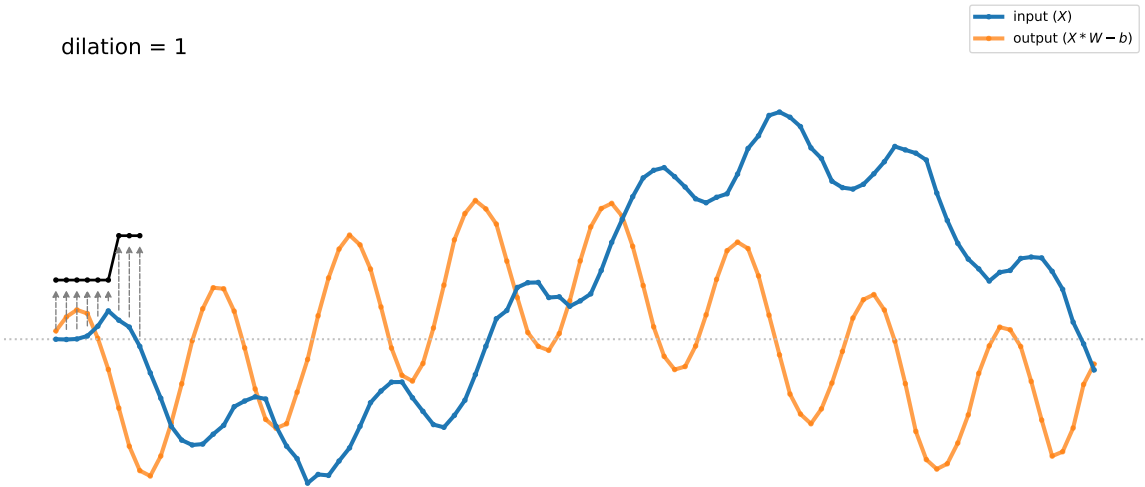



3 ×
$\sum W = 0$
6 ×

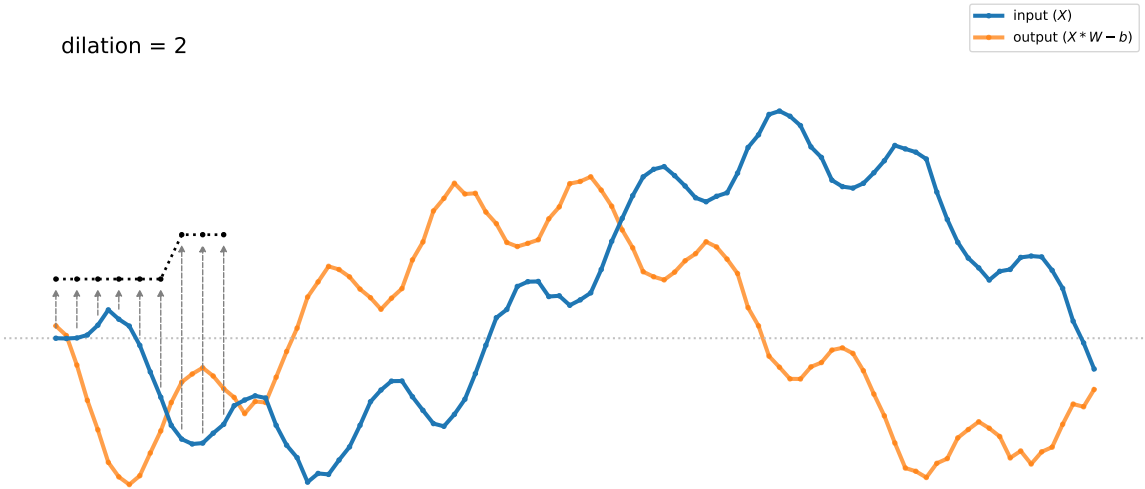


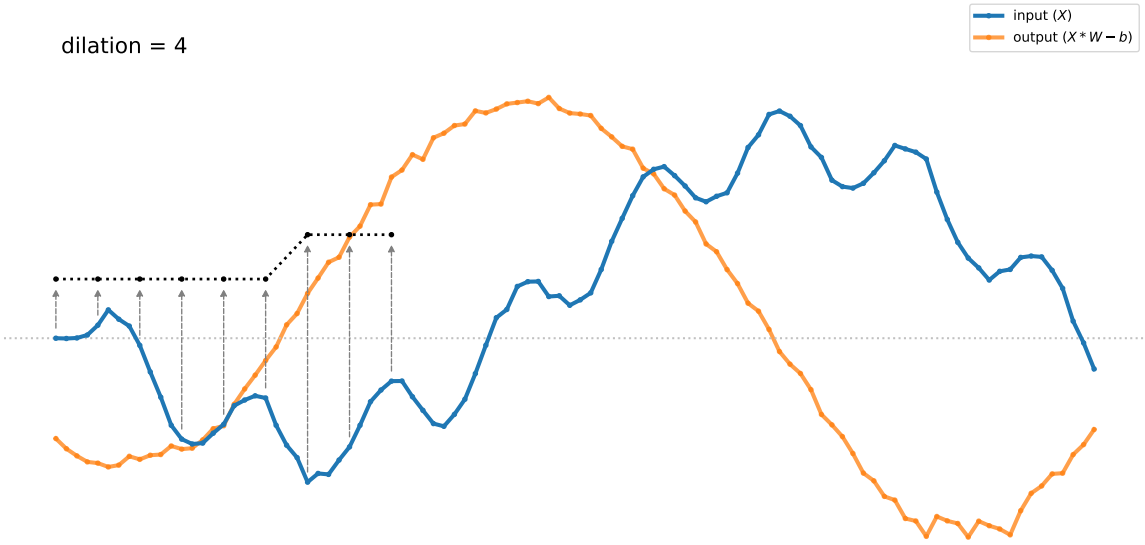


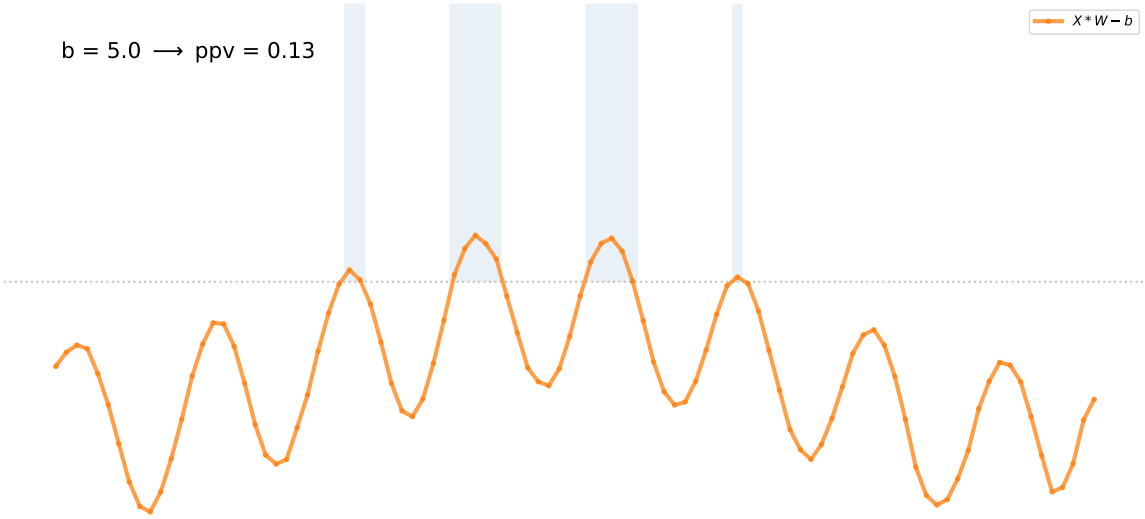


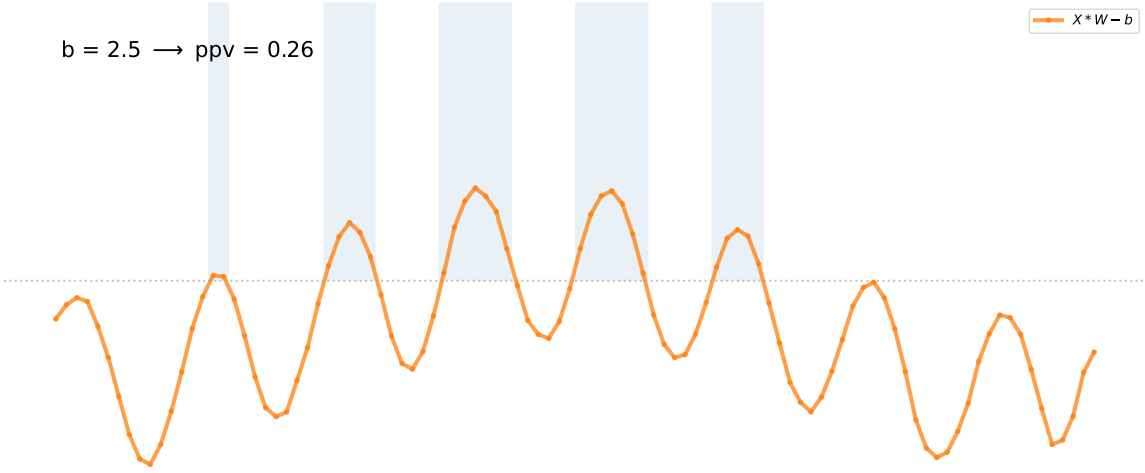

dilation = 1
input (X)
output ($X * W - b$)

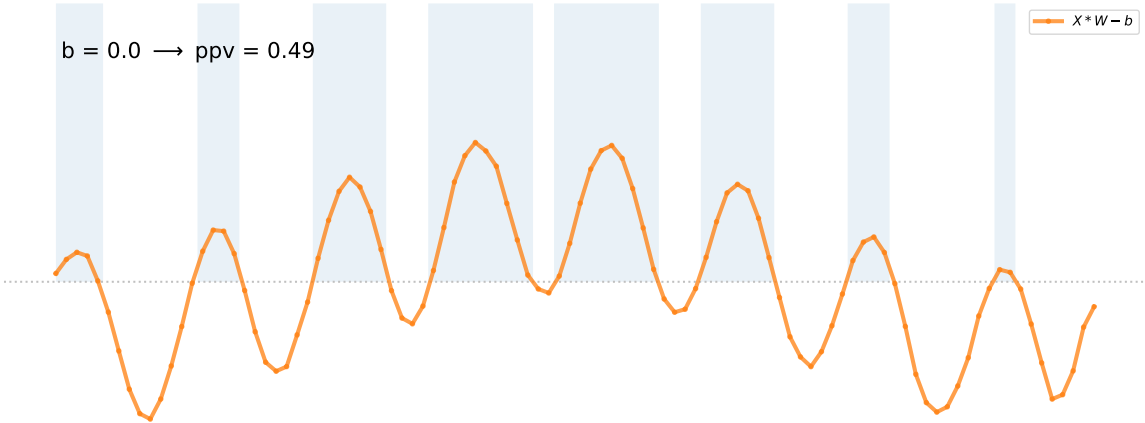
dilation = 2

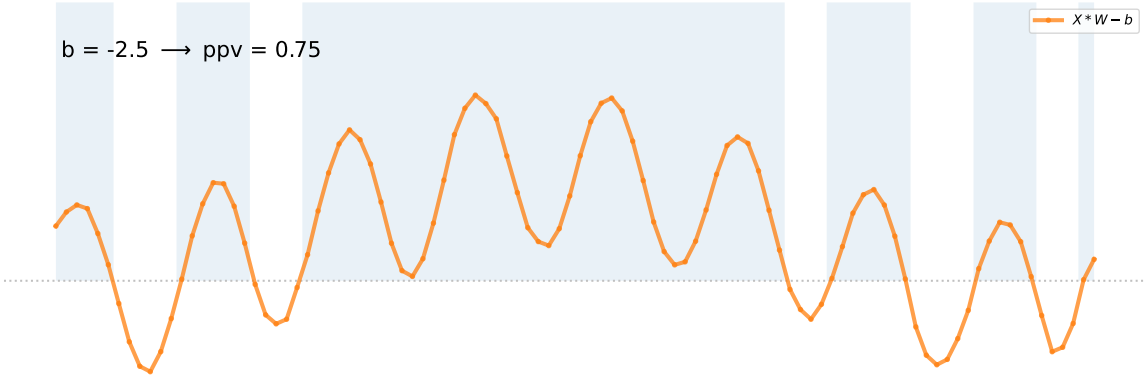


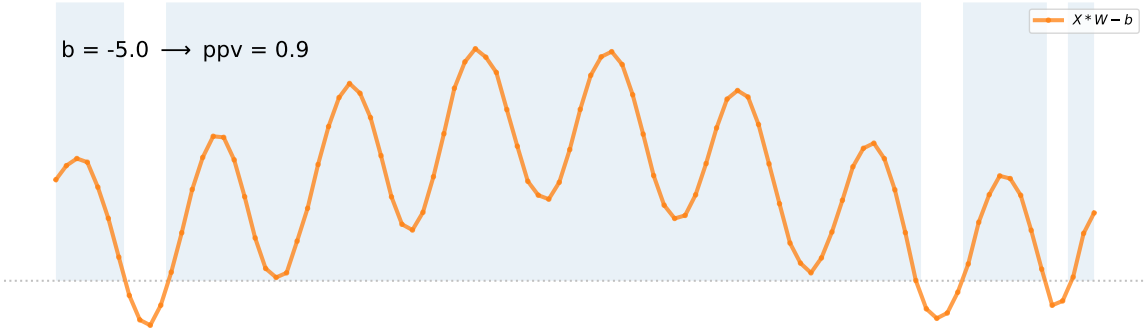

dilation = 4
input (X)
output ($X * W - b$)


b = 5.0 ⟶ ppv = 0.13
X * W − b


b = 2.5 ⟶ ppv = 0.26
X * W − b

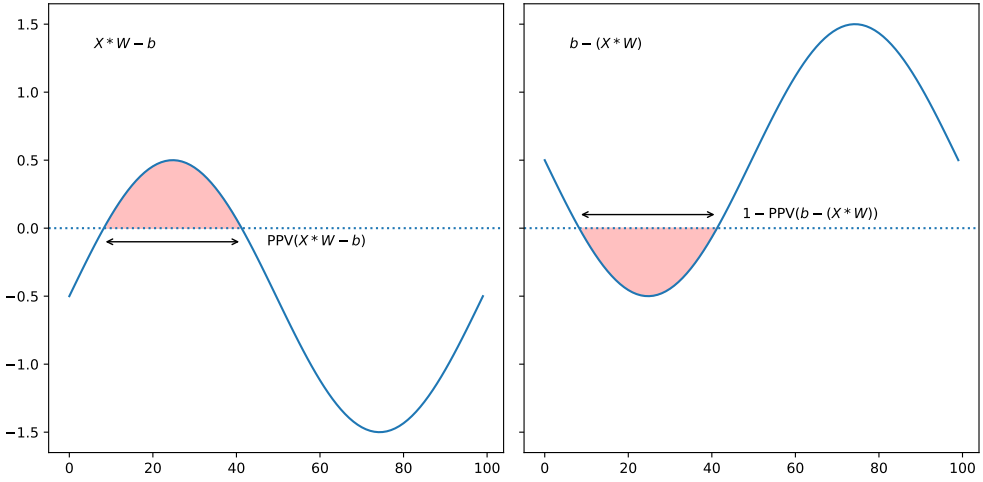

b = 0.0 ⟶ ppv = 0.49
X * W − b

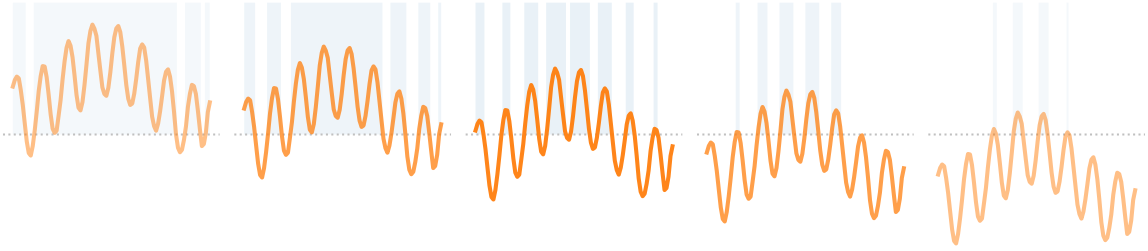

b = -2.5 ⟶ ppv = 0.75
X * W − b

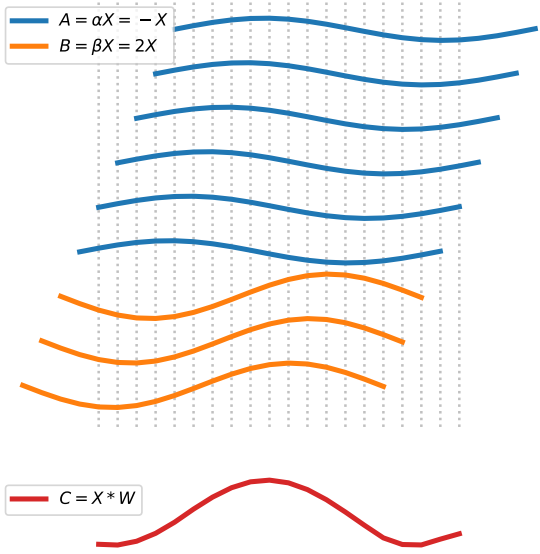

b = -5.0 ⟶ ppv = 0.9
X * W − b

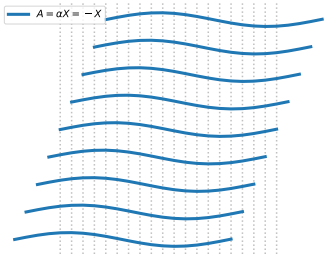
- ridge regression

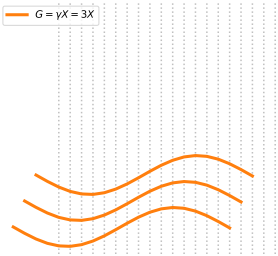
- logistic regression + SGD/Adam

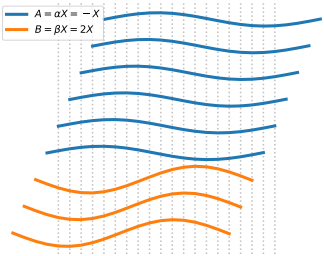

$X * W - b$
PPV$(X * W - b)$
$b - (X * W)$
$1 - \text{PPV}(b - (X * W))$
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
0
20
40
60
80
100




$A = \alpha X = -X$
$B = \beta X = 2X$
$C = X * W$


$A = \alpha X = -X$


$G = \gamma X = 3X$

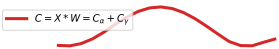

$A = \alpha X = -X$
$B = \beta X = 2X$


C_α

+


C_γ

=


$C = X * W = C_\alpha + C_\gamma$

- significant advance in accuracy vs cost

- significantly faster vs comparable accuracy
- significantly more accurate vs comparable cost

- github[1,2]
- sktime[3]
- fastai[4] (unofficial)

[1] github.com/angus924/rocket
[2] github.com/angus924/minirocket
[3] github.com/alan-turing-institute/sktime
[4] github.com/timeseriesAI/tsai

References

cBOSS	Middlehurst et al. (2019)
CIF	Middlehurst et al. (2020b)
InceptionTime	Ismail Fawaz et al. (2020)
MiniRocket	Dempster et al. (2020b)
Proximity Forest	Lucas et al. (2019)
Rocket	Dempster et al. (2020a)
TDE, HIVE-COTE/TDE	Middlehurst et al. (2020a)
TS-CHIEF	Shifaz et al. (2020)

Dempster A, Petitjean F, Webb GI (2020a) Rocket: Exceptionally Fast and Accurate Time Classification Using Random Convolutional Kernels. Data Mining and Knowledge Discovery 34(5):1454–1495

Dempster A, Schmidt DF, Webb GI (2020b) MiniRocket: A Very Fast (Almost) Deterministic Transform for Time Series Classification, arXiv:2012.08791

Ismail Fawaz H, Lucas B, Forestier G, Pelletier C, Schmidt DF, Weber J, Webb GI, Idoumghar L, Muller P, Petitjean F (2020) InceptionTime: Finding AlexNet for time series classification. Data Mining and Knowledge Discovery 34(6):1936–1962

Lucas B, Shifaz A, Pelletier C, O'Neill L, Zaidi N, Goethals B, Petitjean F, Webb GI (2019) Proximity Forest: an effective and scalable distance-based classifier for time series. Data Mining and Knowledge Discovery 33(3):607–635

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Middlehurst M, Large J, Cawley G, Bagnall A (2020a) The Temporal Dictionary Ensemble (TDE) classifier for time series classification. In: ECML PKDD

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