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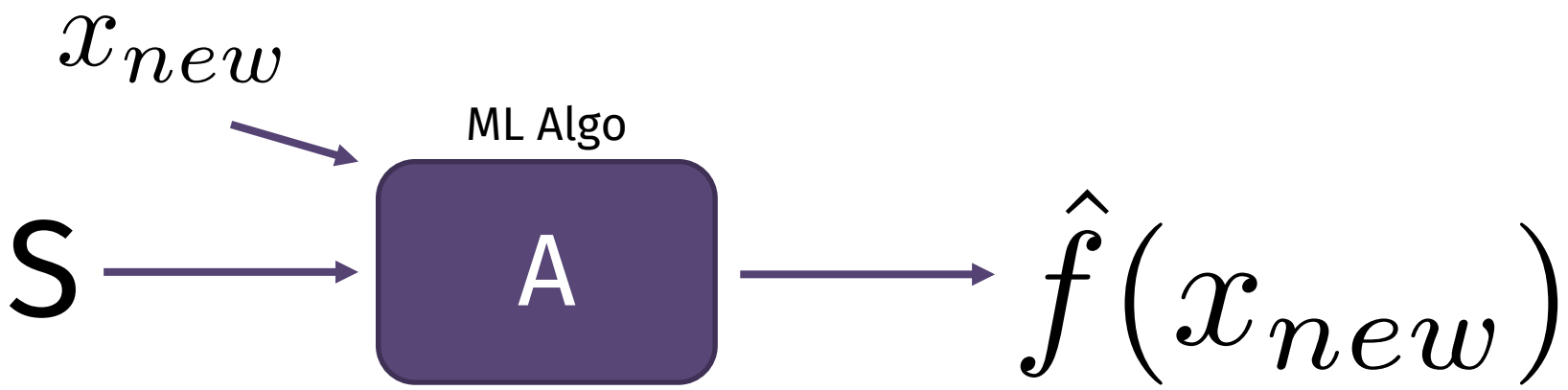
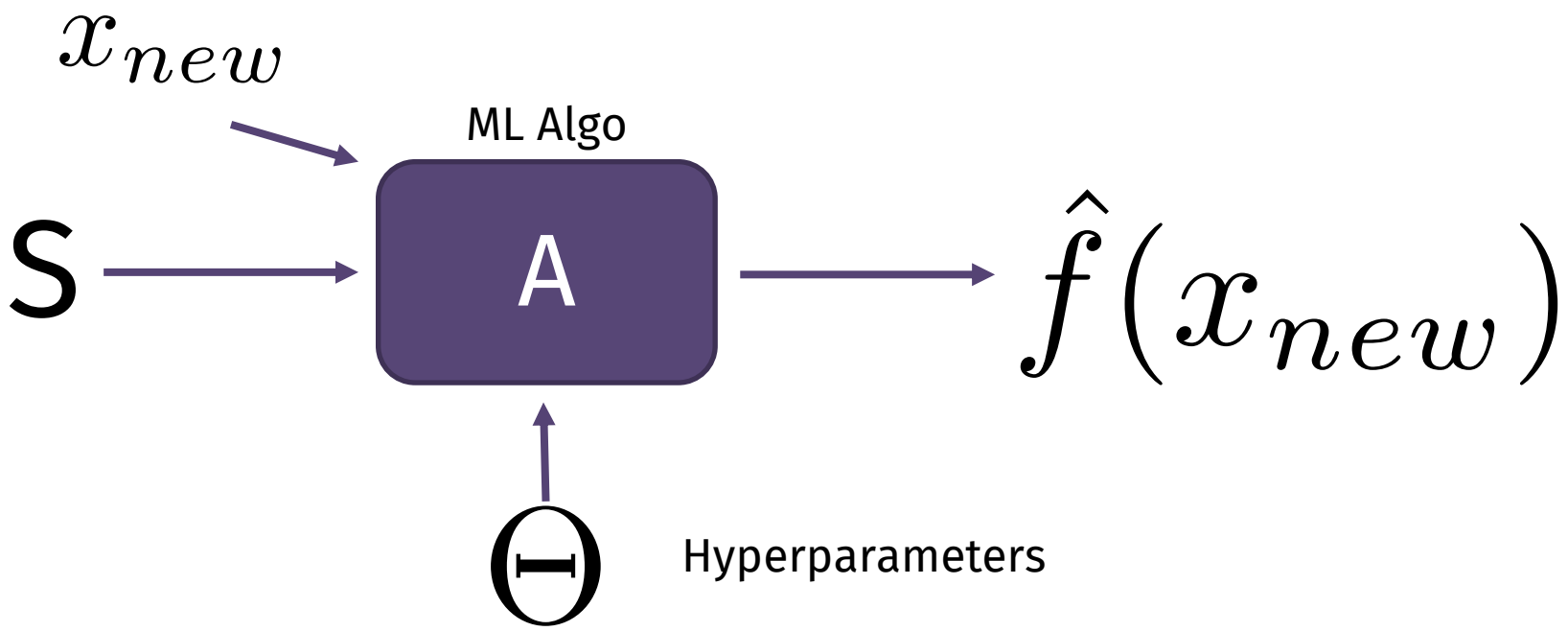
Lab 2 –Cross Validation

ML algorithms and hyperparameters

ML algorithms and hyperparameters

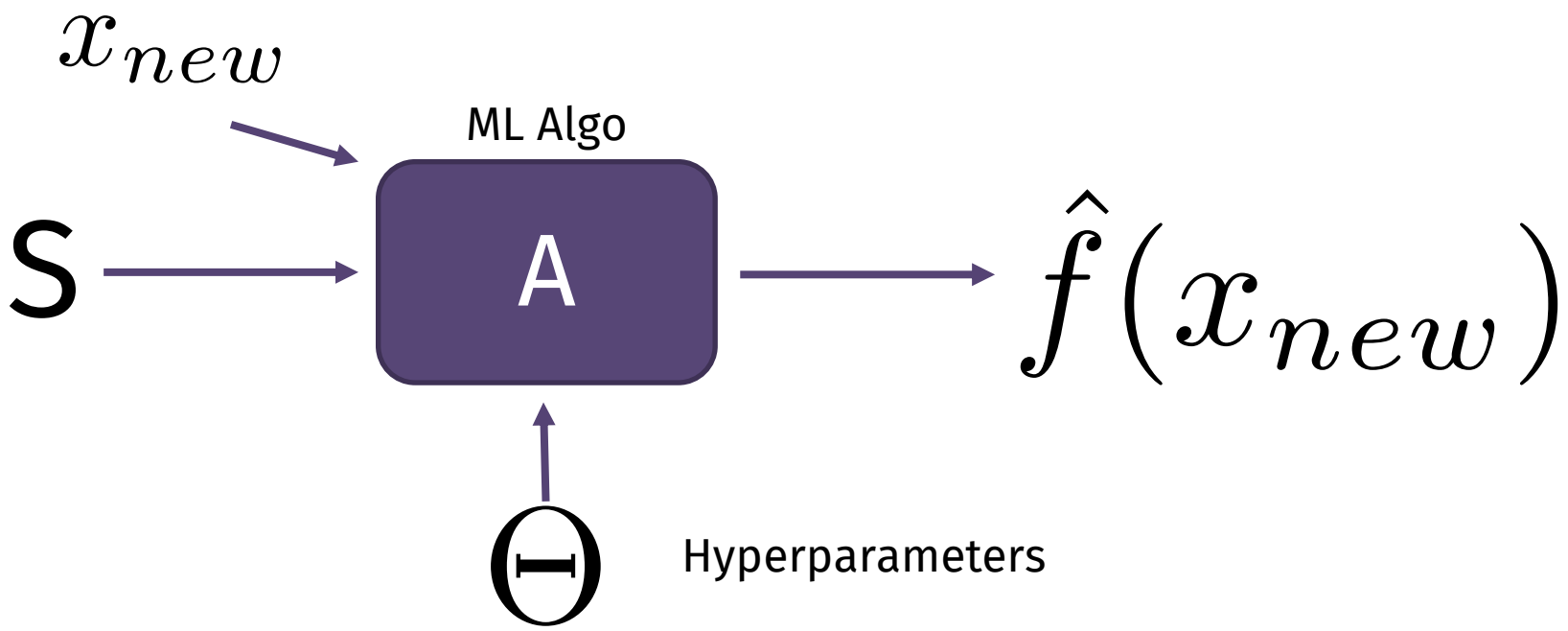


ML algorithms and hyperparameters



$$A_\Theta(S) = \hat{f}_\Theta$$

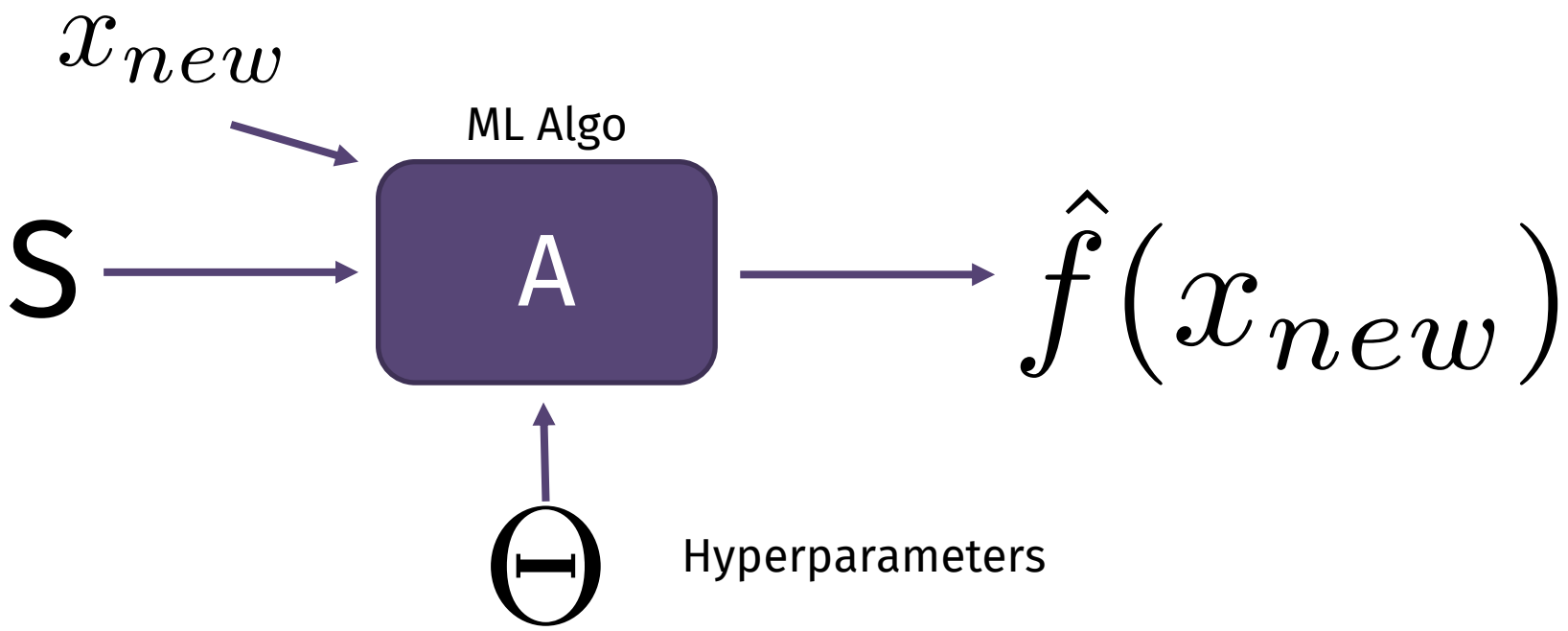
ML algorithms and hyperparameters



$$A_\Theta(S) = \hat{f}_\Theta$$

Is there an optimal value for the hyperparameter?

ML algorithms and hyperparameters



$$A_\Theta(S) = \hat{f}_\Theta$$

Is there an optimal value for the hyperparameter?

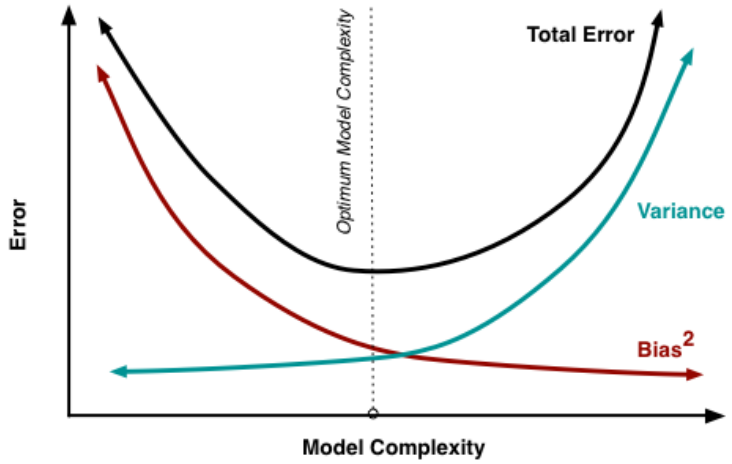
The one for which the test error is **small**

Is there a optimal value?

After some math...

$$\mathbf{E}_S\mathbf{E}_{y|x}(f_*(x) - \hat{f}_K(x))^2 = \underbrace{(f_*(x) - \mathbf{E}_S\mathbf{E}_{y|x}\hat{f}_K(x))^2}_{Bias} + \underbrace{\mathbf{E}_S\mathbf{E}_{y|x}(\mathbf{E}_{y|x}\hat{f}_K(x) - \hat{f}_K(x))^2}_{Variance}$$

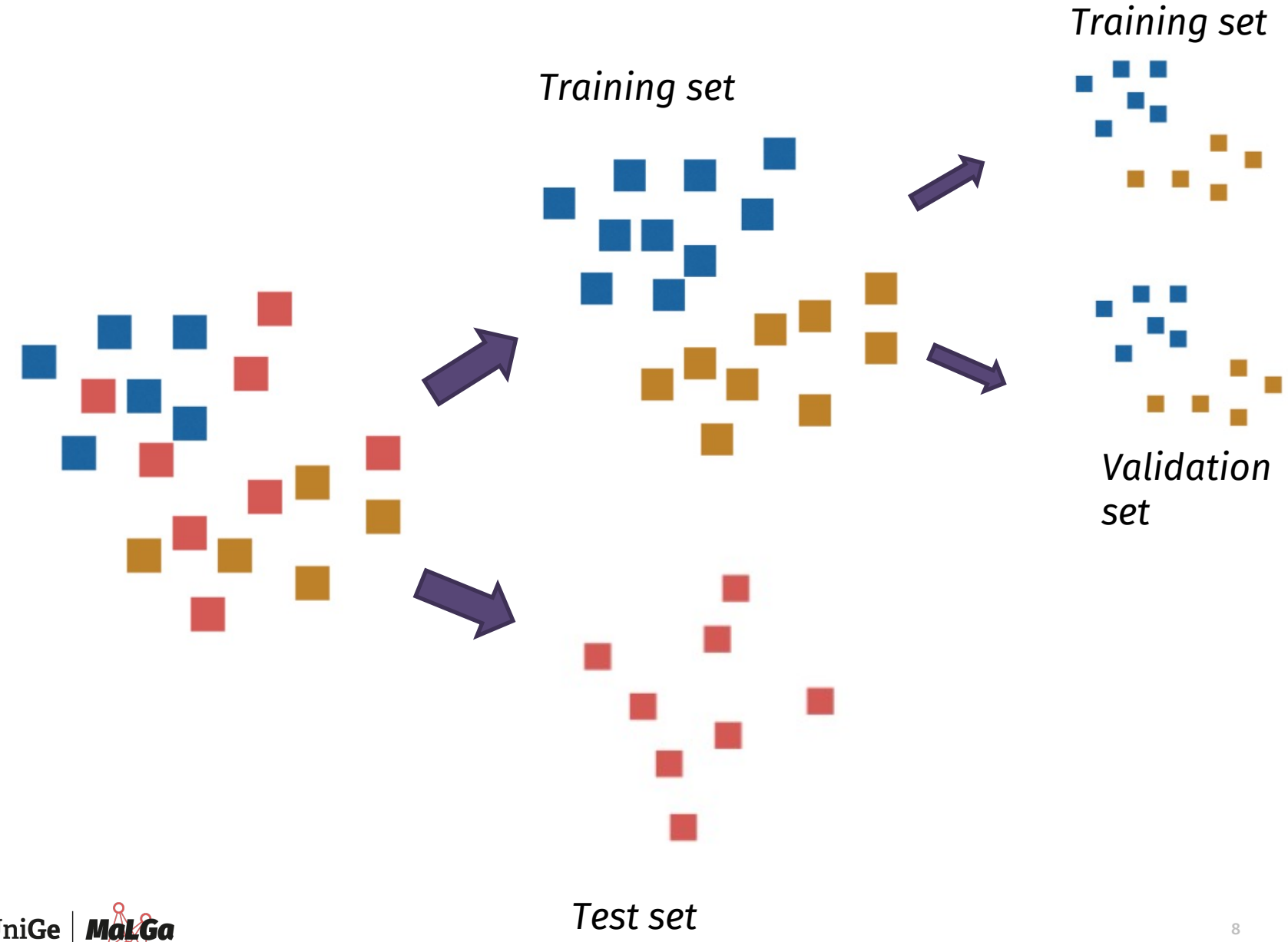
$$(f_*(x) - \frac{1}{K}\sum_{\ell \in K_x} f_*(x_\ell))^2 \qquad \frac{\sigma^2}{K}$$



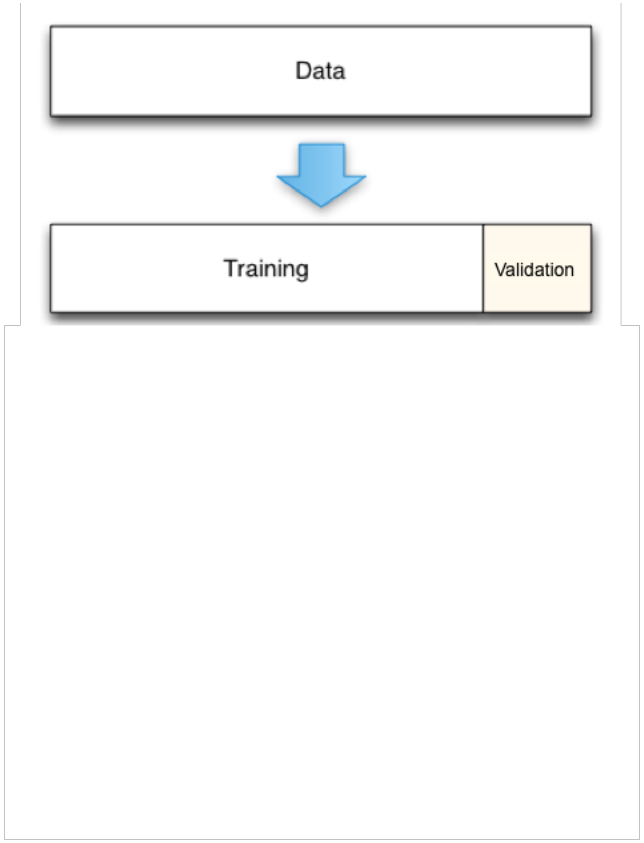
Is there an optimal value?

Can it be computed?

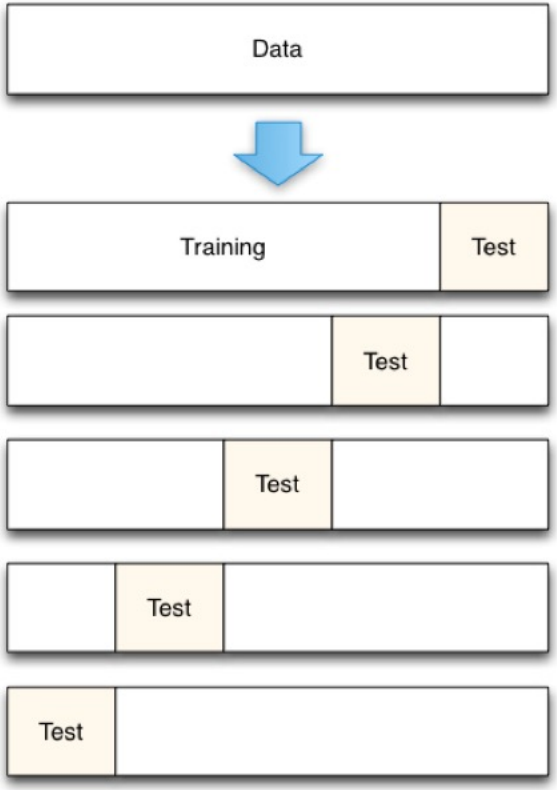
Cross Validation



Hold-Out Cross Validation



K-Fold Cross Validation



Your objectives today

Practicing the selection of an appropriate value for the K parameter using Cross Validation, by doing the following

- Pretending to have the test set (and in fact you have it in these examples) and have a look to the trend of the error
- What if you select K minimizing the error on the training set?
- What if you select K using hold-out CV?
- What if you select K using K-fold CV?

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