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Online Variance Reduction with Mixtures

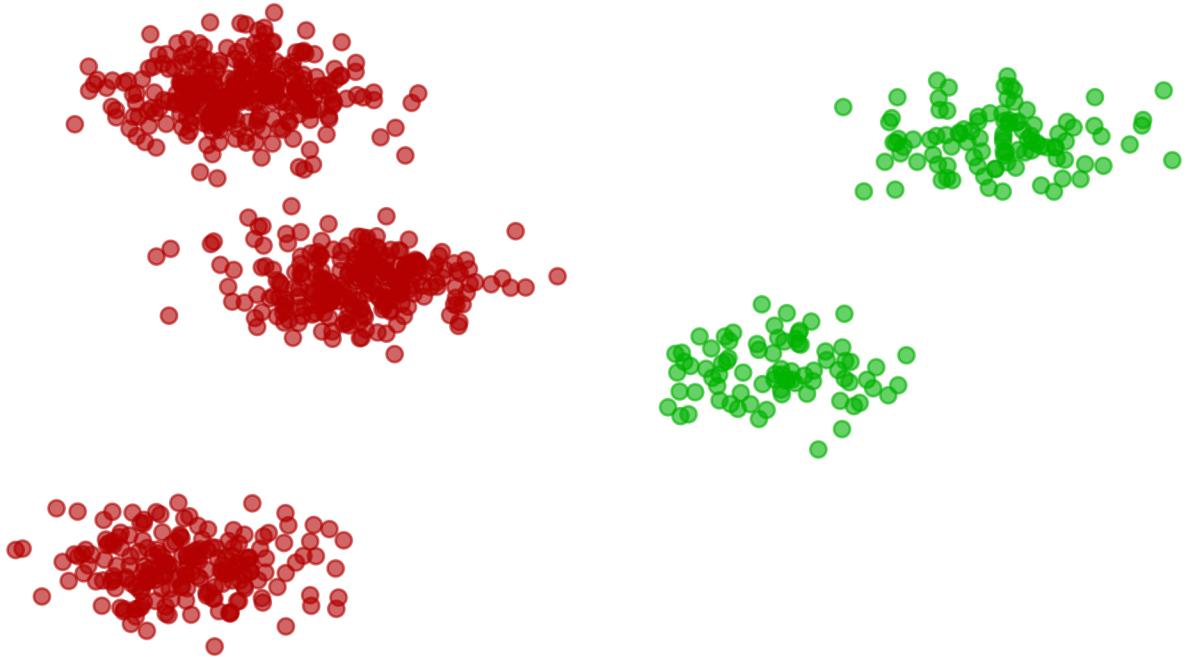
Zalán Borsos, Sebastian Curi, Kfir Y. Levy and Andreas Krause

Department of Computer Science, ETH Zurich

DINFK

Learning & Adaptive Systems

Motivation



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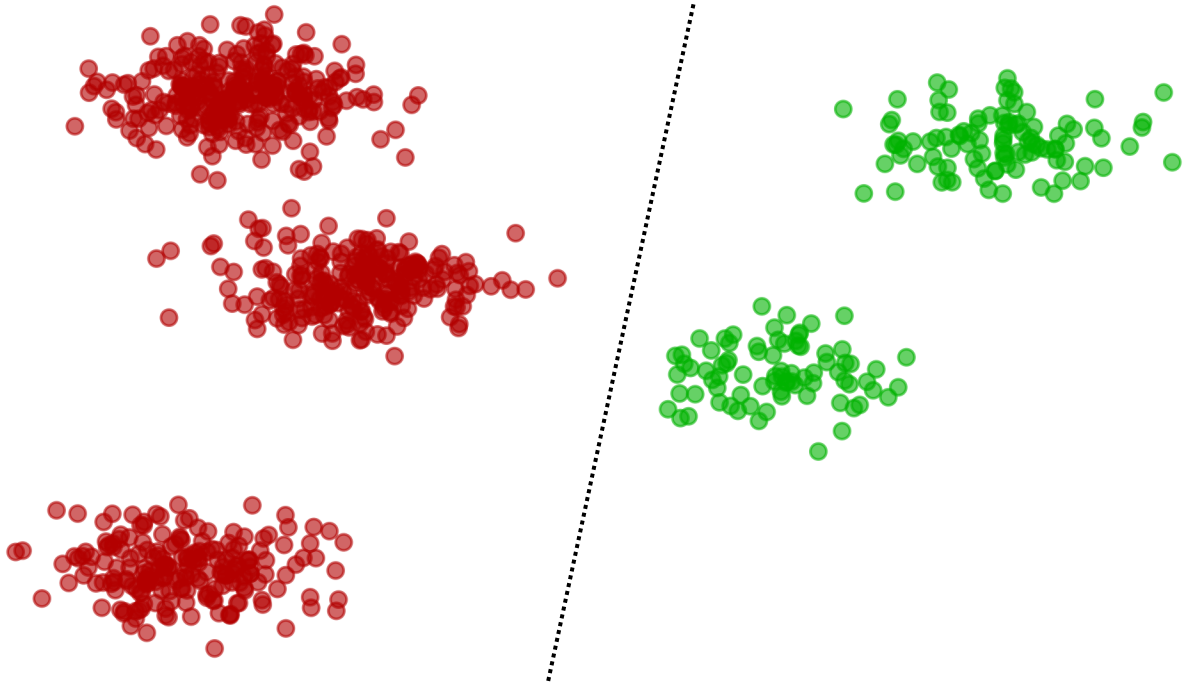

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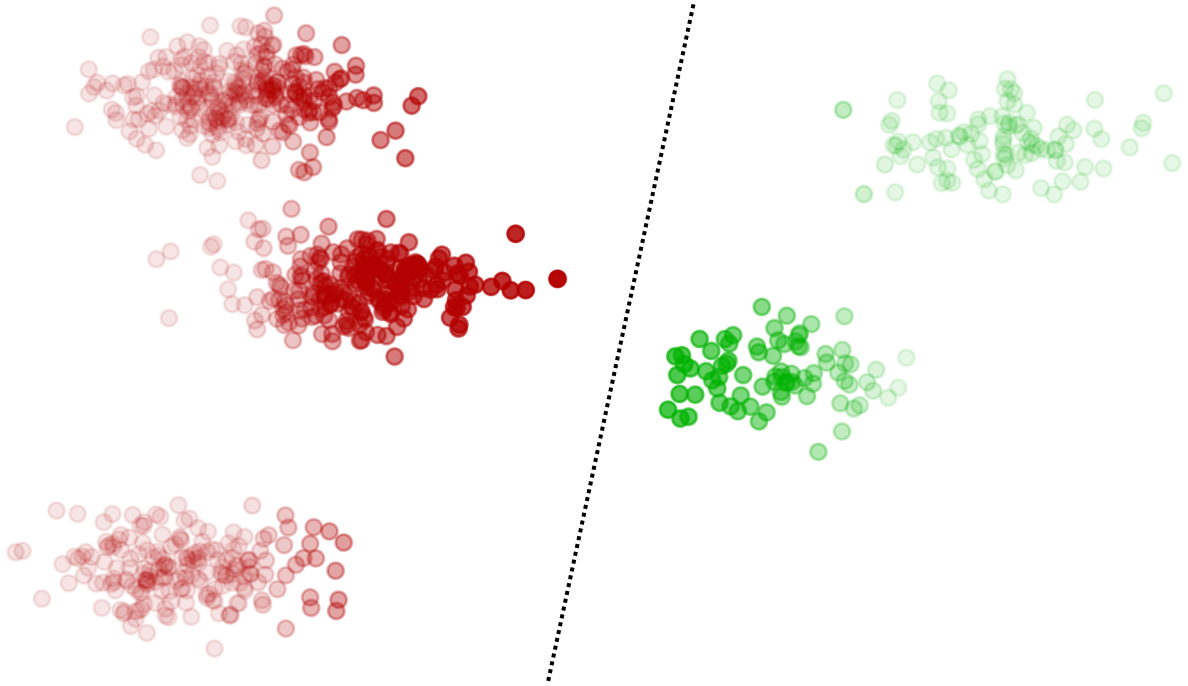

Adaptive importance sampling of data points

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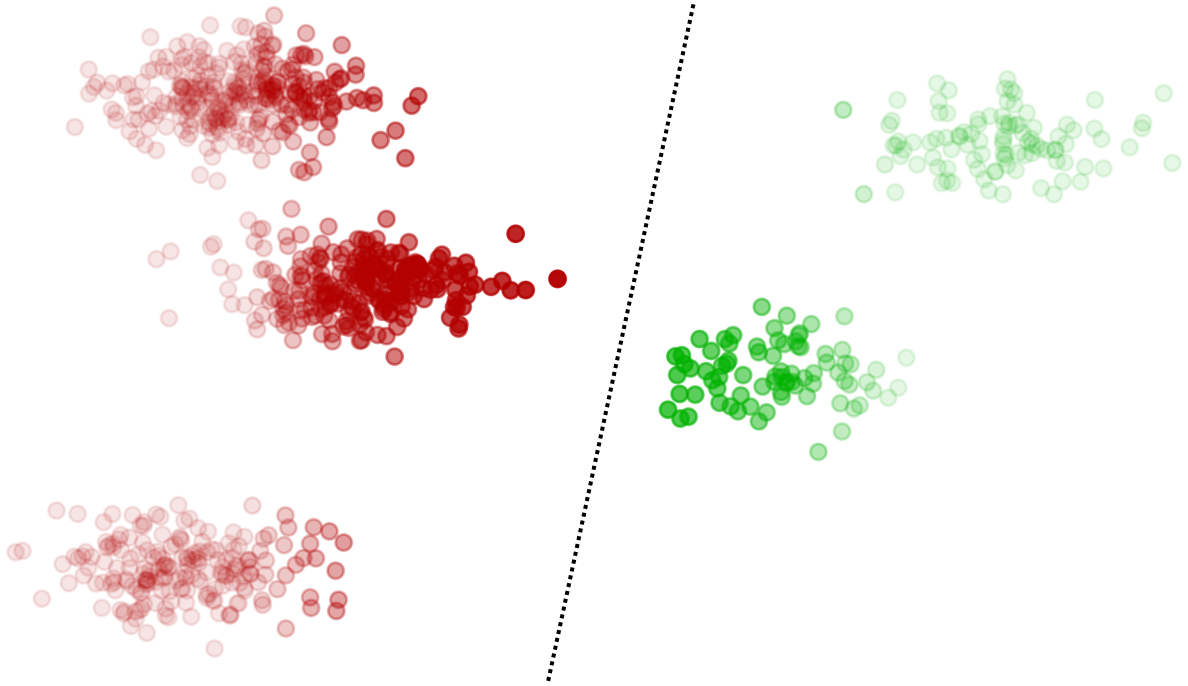
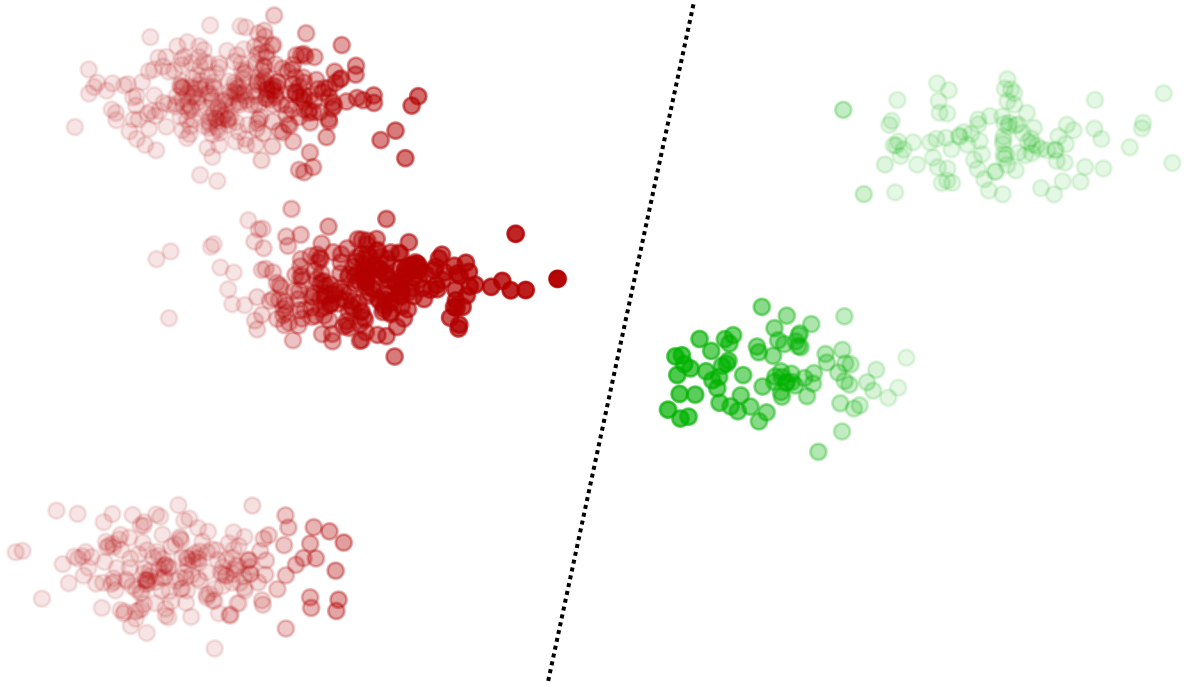


Adaptive importance sampling of data points

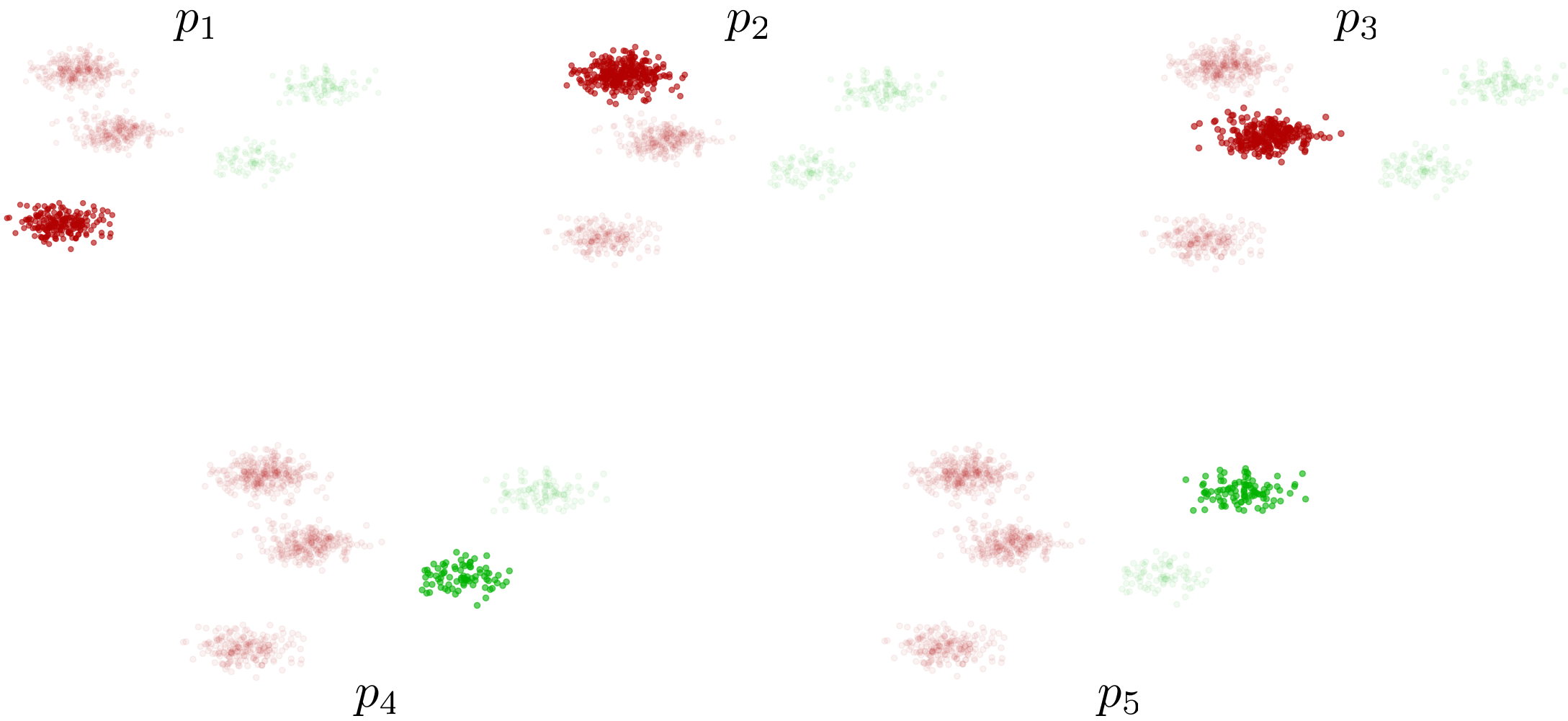
Dependence on n

Motivation



How can we exploit **prior knowledge** about the data?

Motivation



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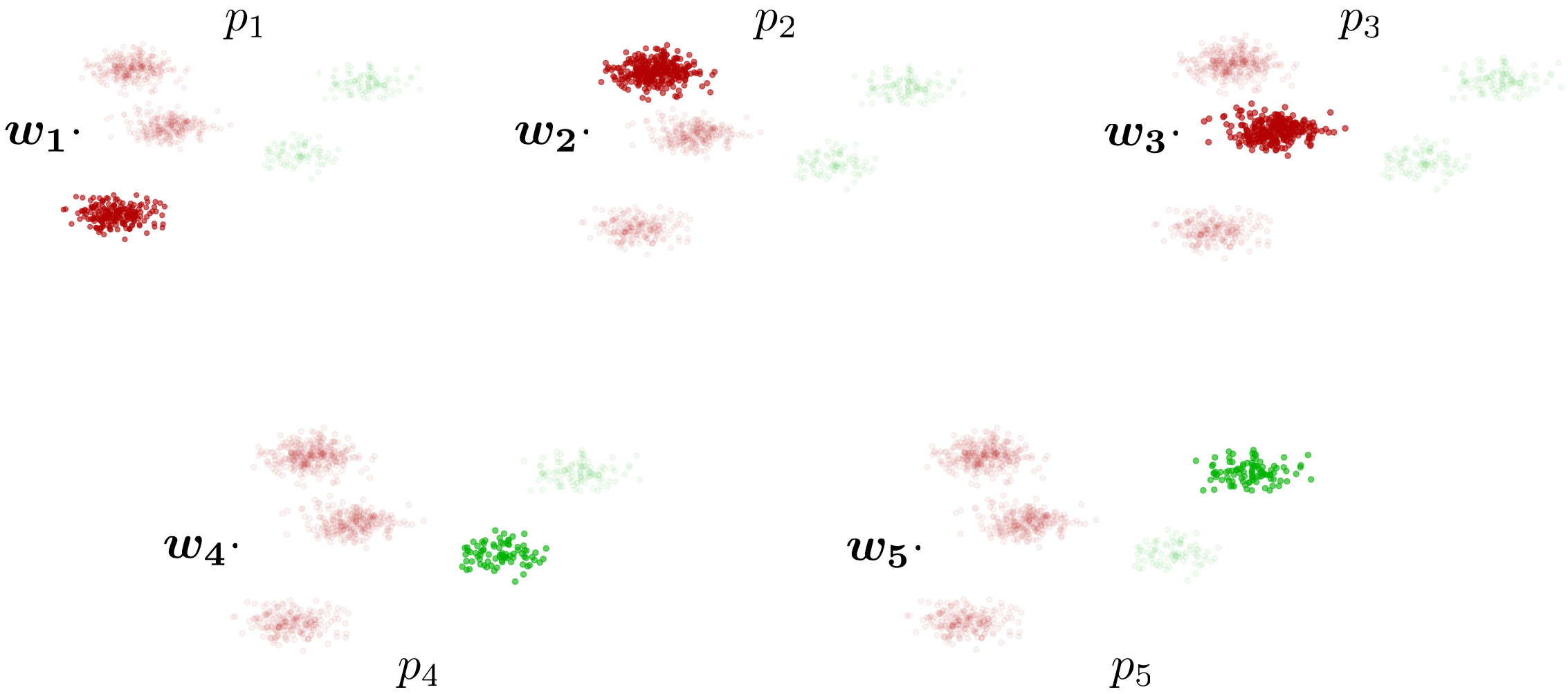
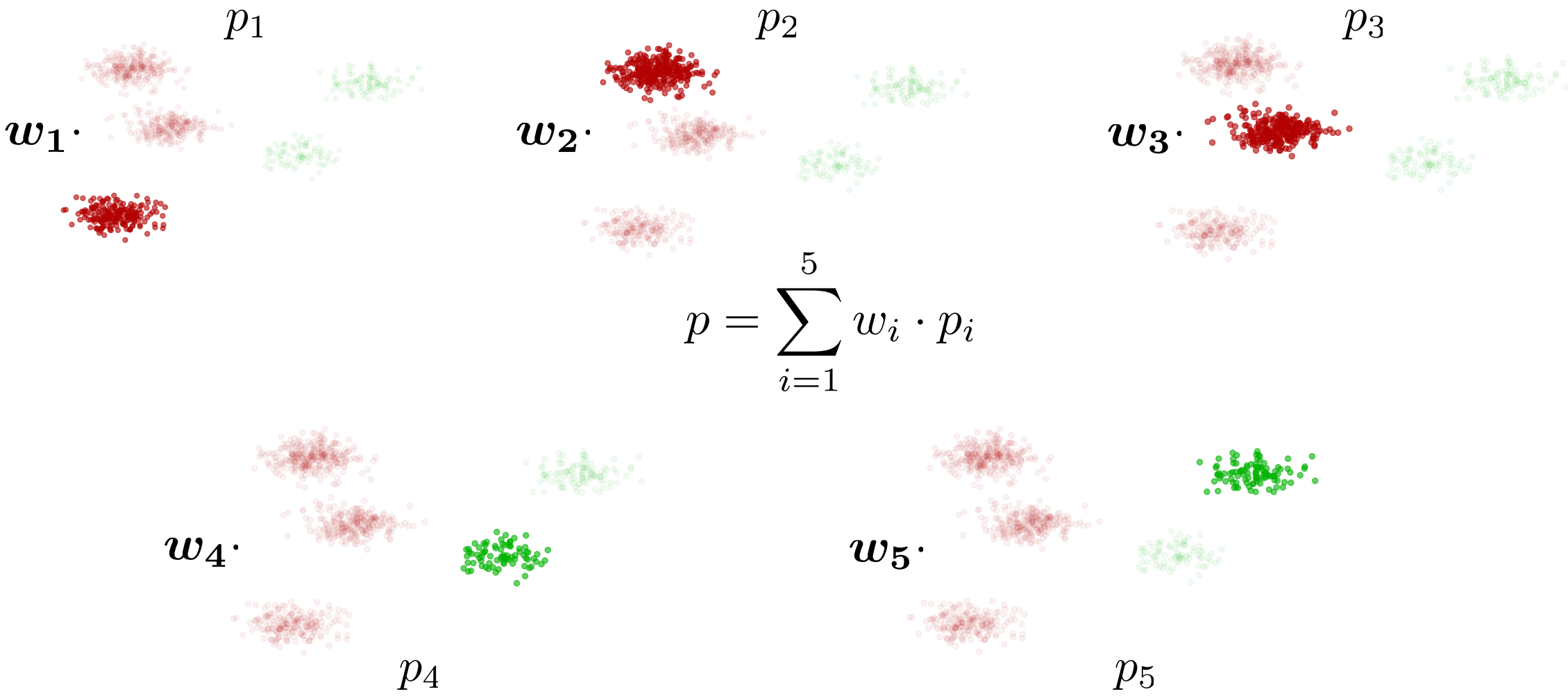
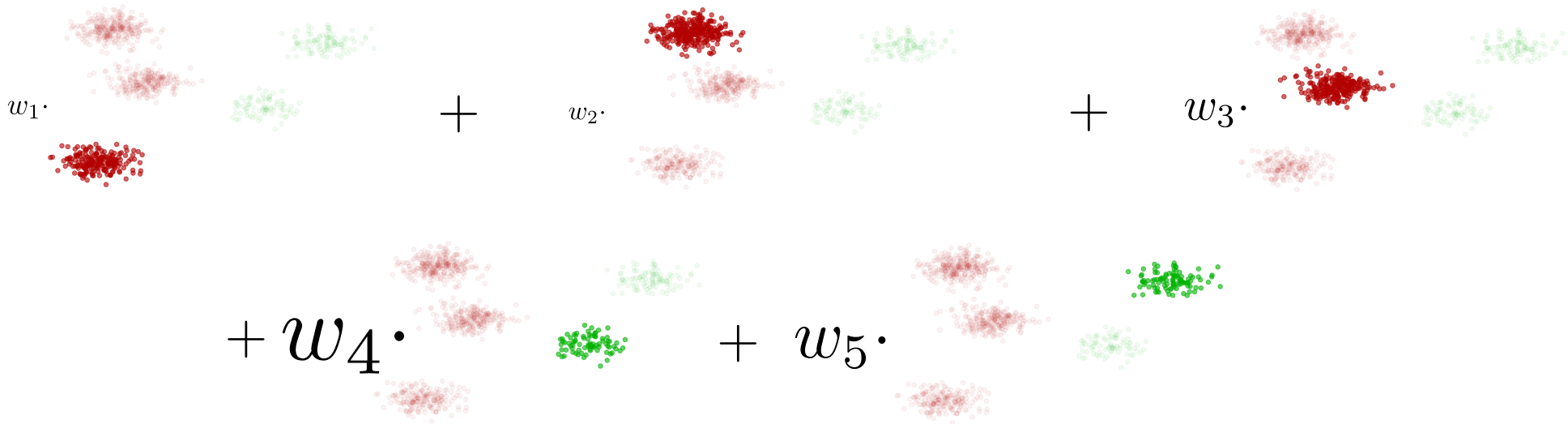

p_1
p_2
p_3
$\boldsymbol{w_1}\cdot$
$\boldsymbol{w_2}\cdot$
$\boldsymbol{w_3}\cdot$
$\boldsymbol{w_4}\cdot$
$\boldsymbol{w_5}\cdot$
p_4
p_5

Motivation

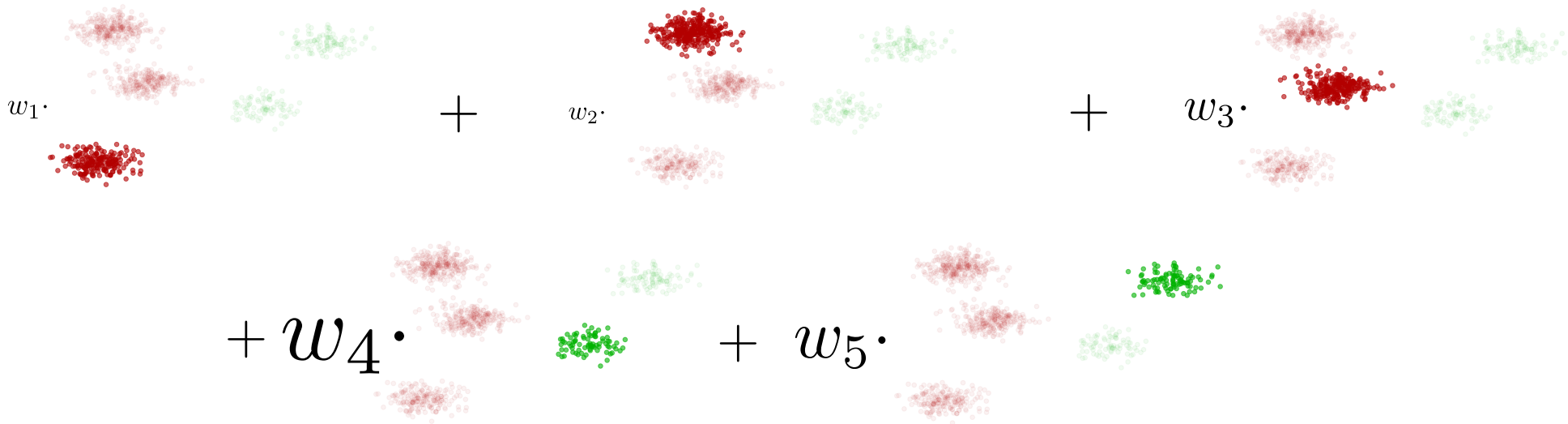

p_1
p_2
p_3
$\boldsymbol{w_1}\cdot$
$\boldsymbol{w_2}\cdot$
$\boldsymbol{w_3}\cdot$
$p = \sum_{i=1}^{5} w_i \cdot p_i$
$\boldsymbol{w_4}\cdot$
$\boldsymbol{w_5}\cdot$
p_4
p_5

Method



Adapt $w_1, \ldots, w_5$ ⟶ Adaptive importance sampling with **mixtures**

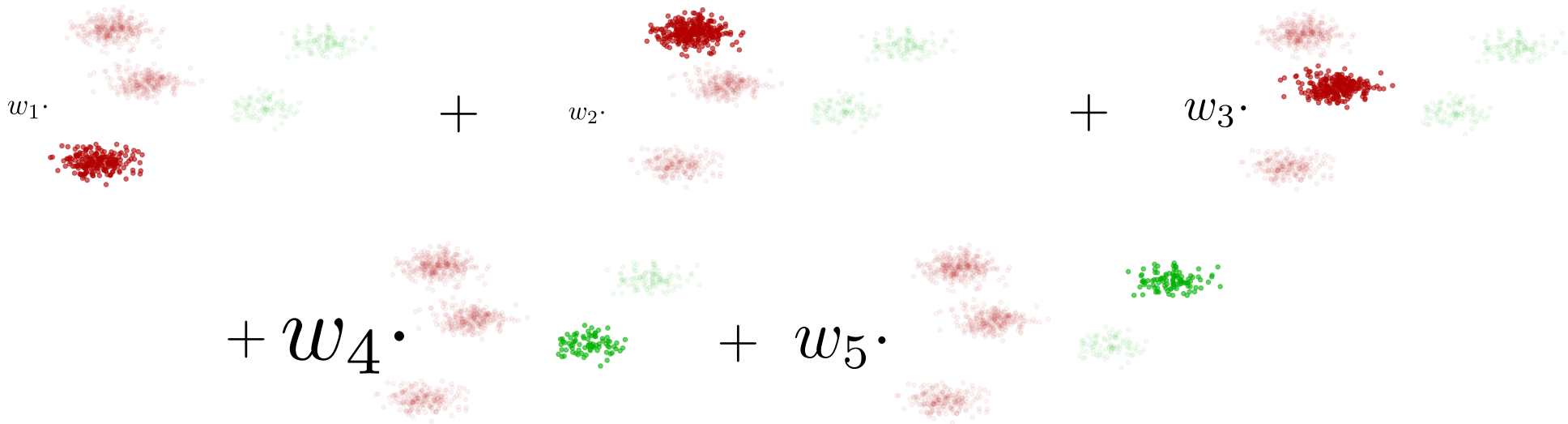
Method



Adapt $w_1, \ldots, w_5$ ⟶ Adaptive importance sampling with **mixtures**

Cost function $f(w)$: cumulative variance of loss estimates

Method

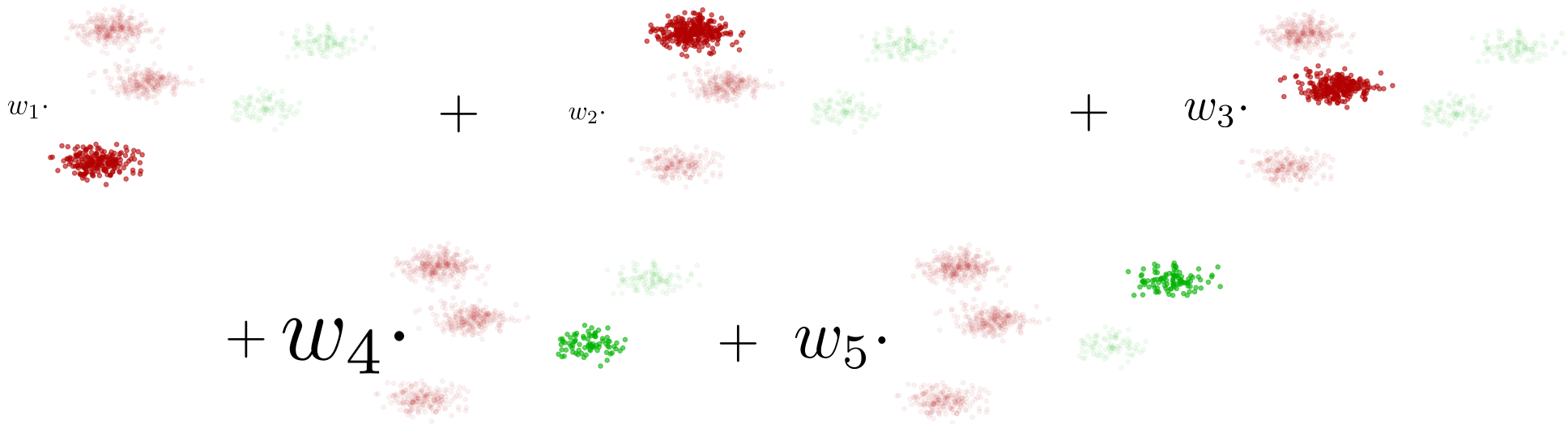


Adapt $w_1, \ldots, w_5$ ⟶ Adaptive importance sampling with **mixtures**

Cost function $f(w)$: cumulative variance of loss estimates

No-regret algorithm for adapting the weights inspired by Online Newton Step

Method



Adapt $w_1, \ldots, w_5$ ⟶ Adaptive importance sampling with **mixtures**

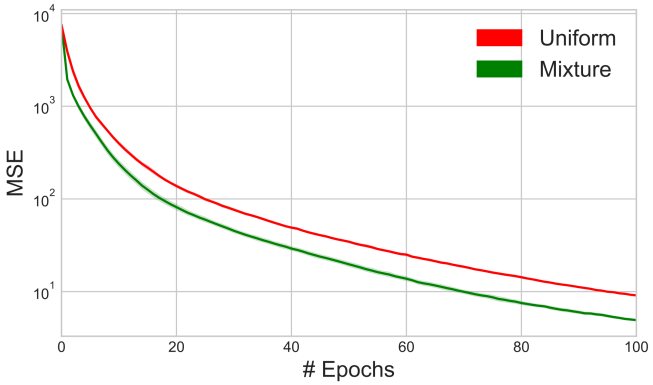
Cost function $f(w)$: cumulative variance of loss estimates

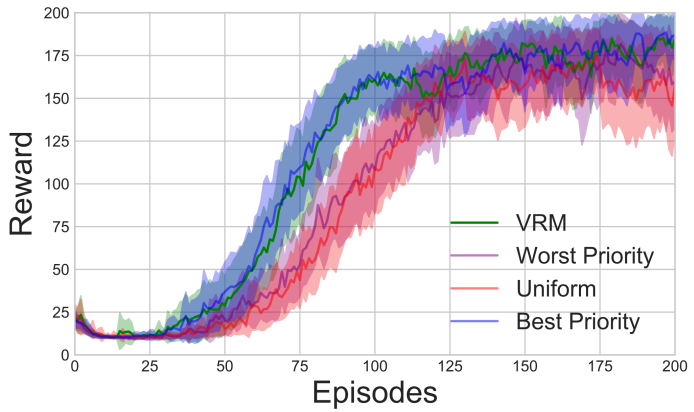
No-regret algorithm for adapting the weights inspired by Online Newton Step

Regret independent of n

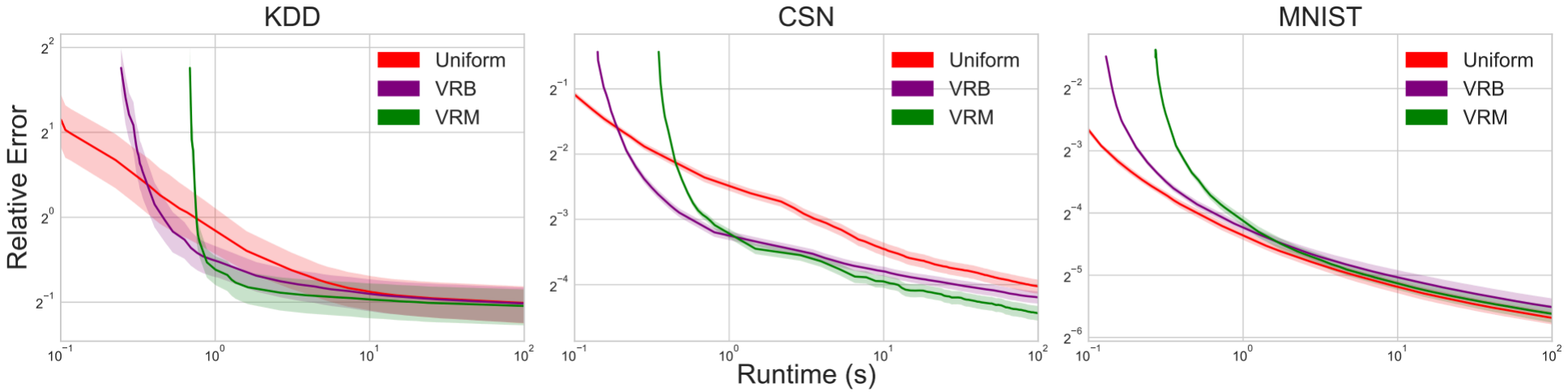
Results

k-DPP minibatch sampling in SGD for regression





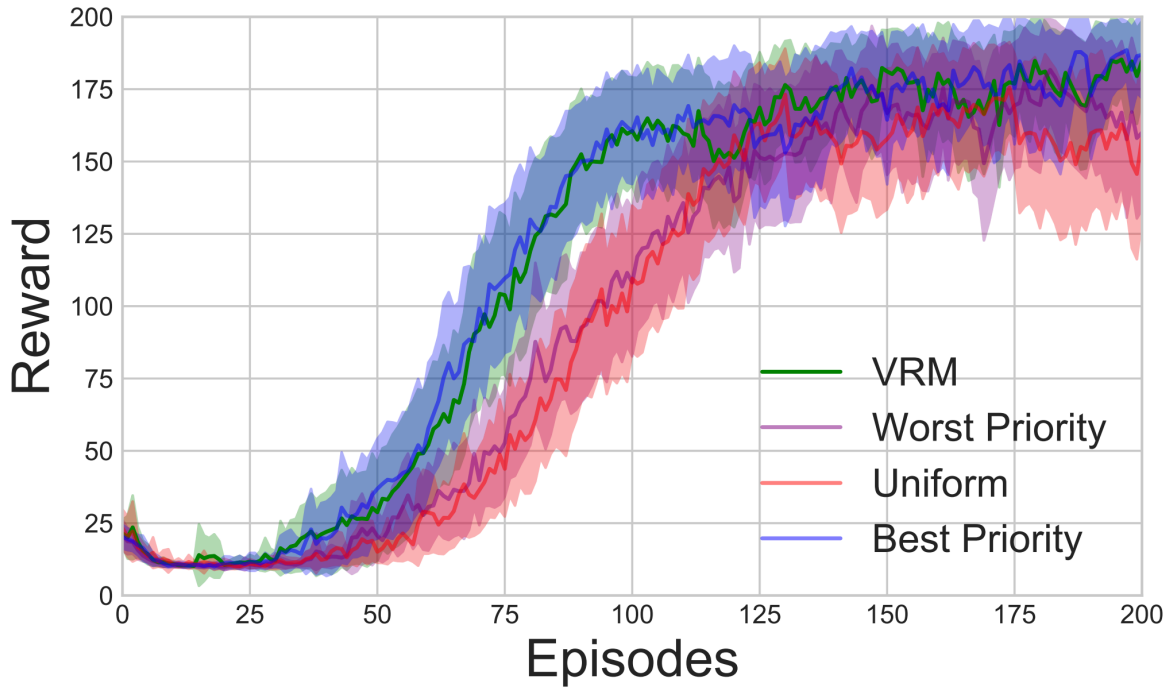
DQN with prioritized experience replay



Minibatch k-means

Results

Prioritized experience replay: $p_i \propto f(\delta_i, \varepsilon, \alpha)$



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