Solving The Art Gallery Problem Using Gradient Descent

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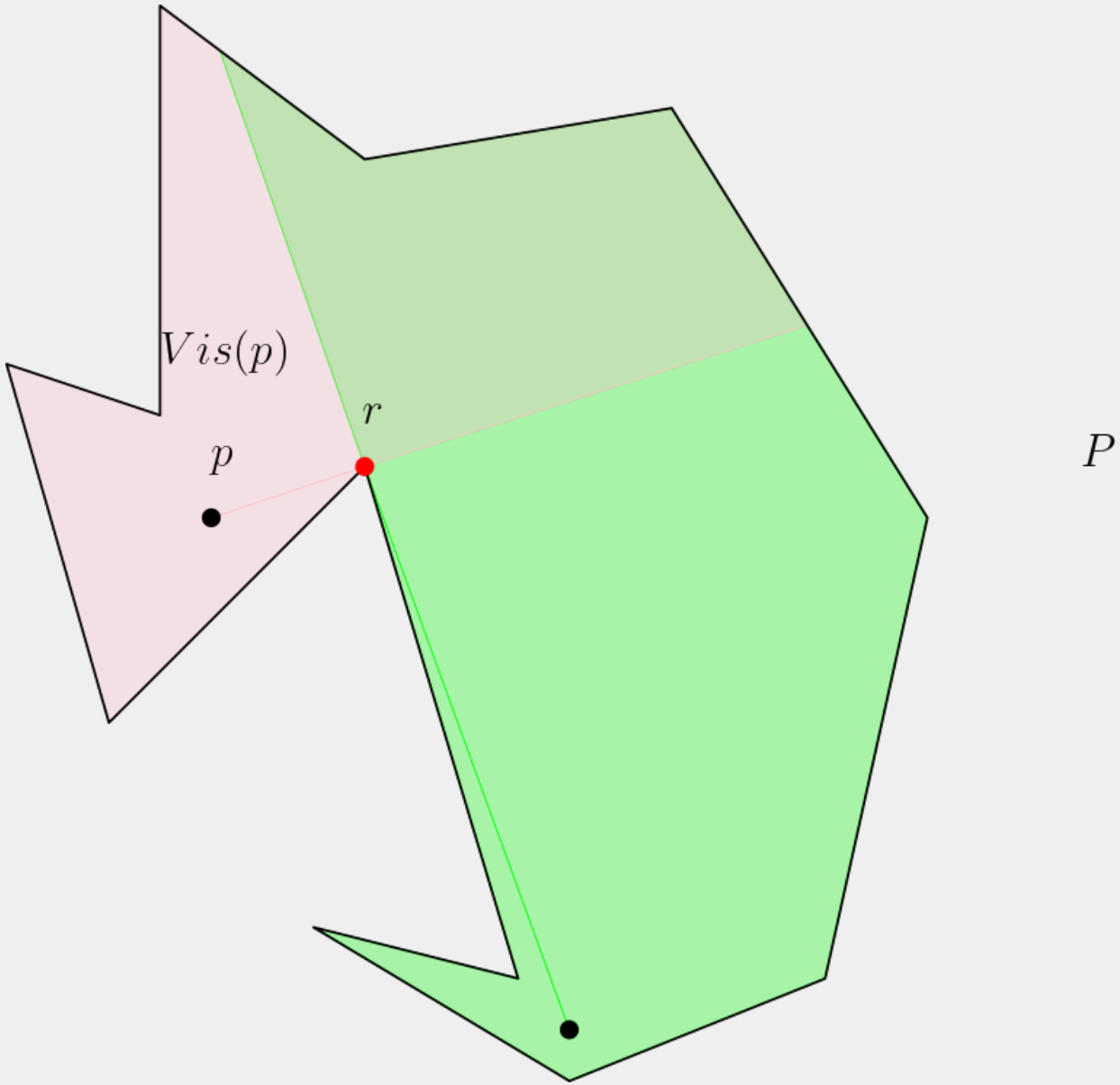
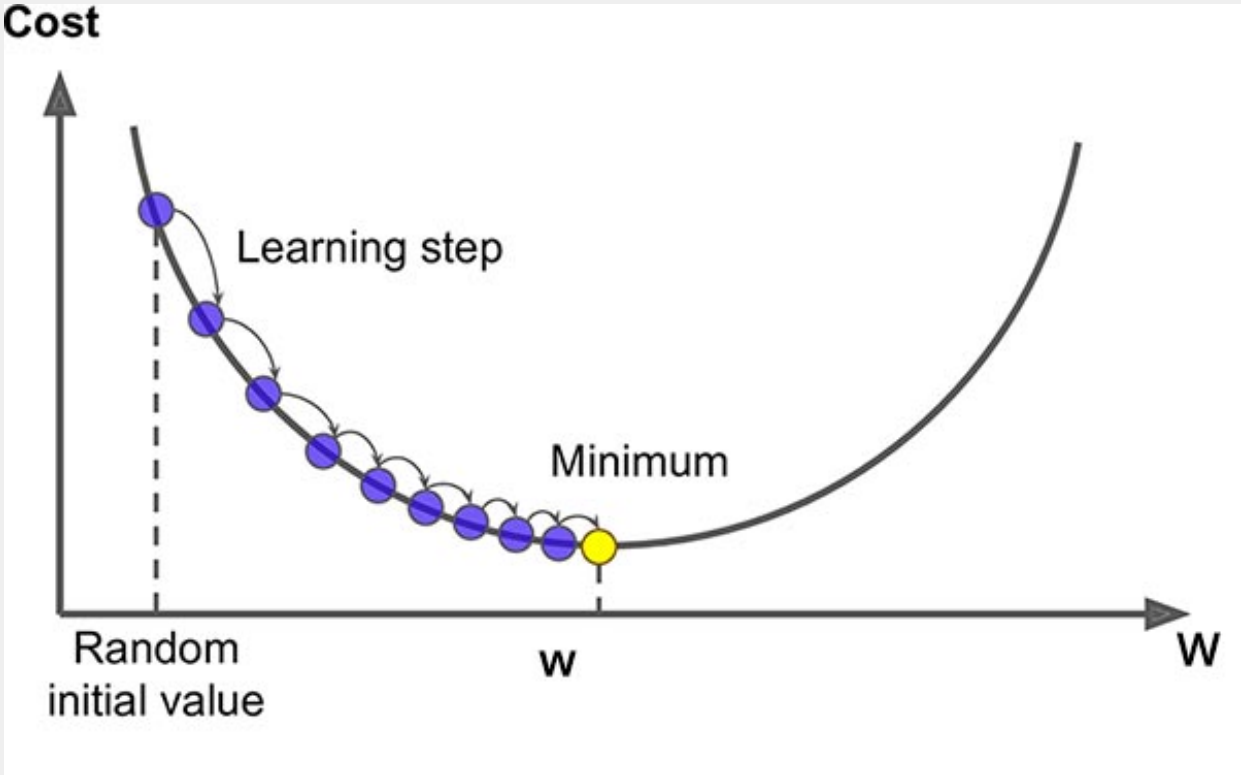
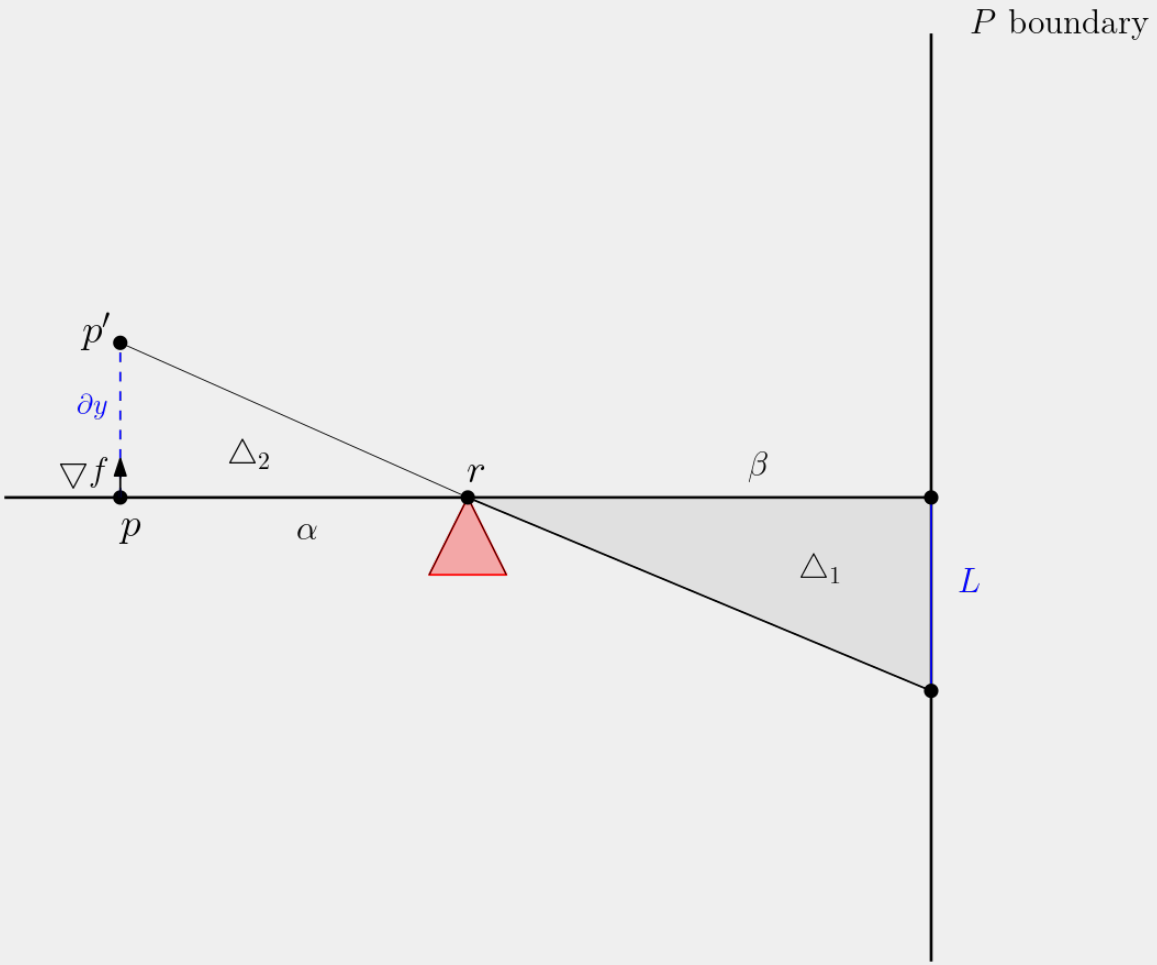
The Art Gallery Problem



Gradient Descent



Theory

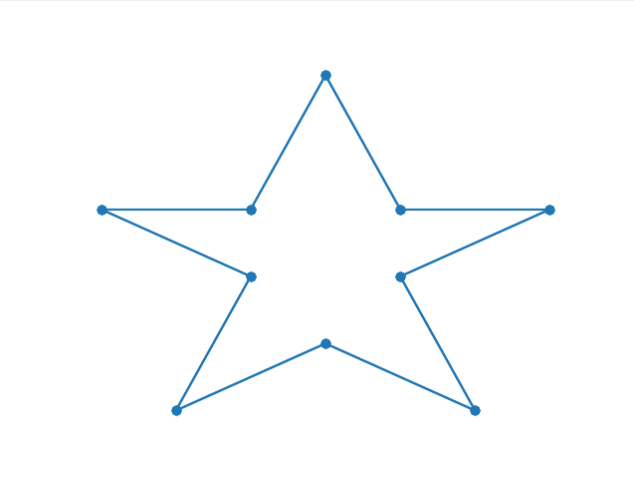


$$\nabla f = \left(0, \frac{\beta^2}{2\alpha}\right)^T$$

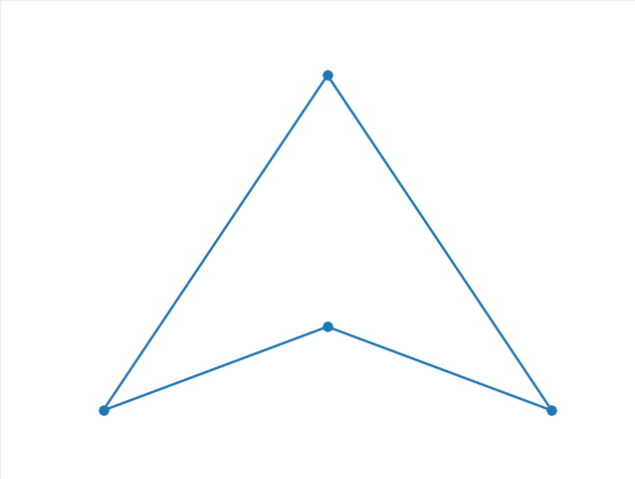
$$p' = p + \alpha \nabla f,$$

$\alpha-$ learning rate

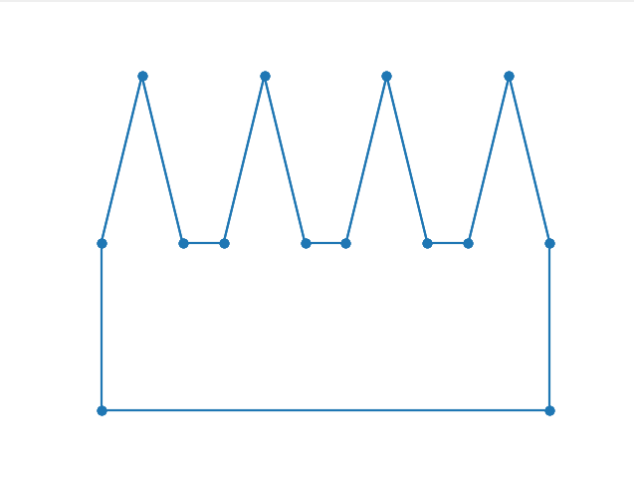
Practice



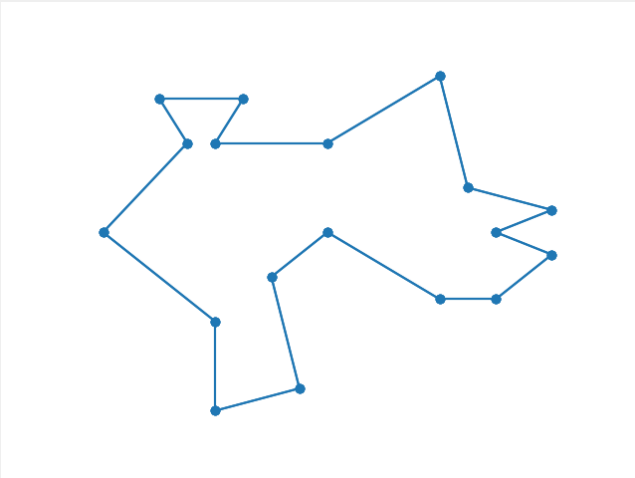
(a) Star polygon.



(b) Arrowhead polygon.

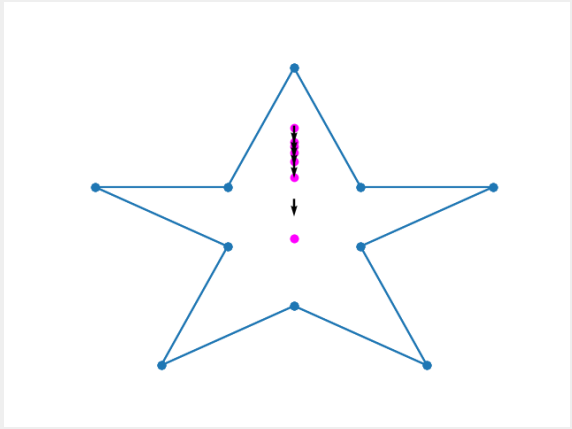


(c) Comb polygon.

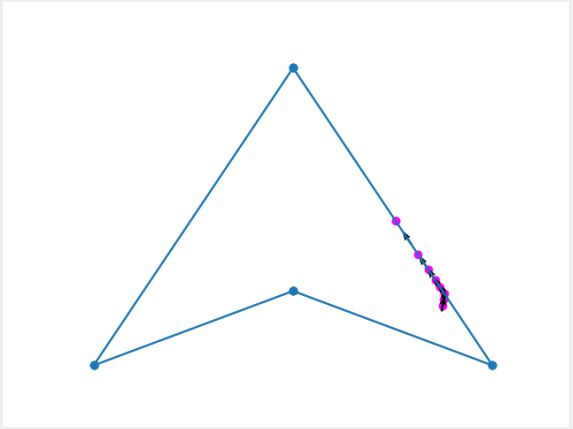


(d) Arbitrary polygon.

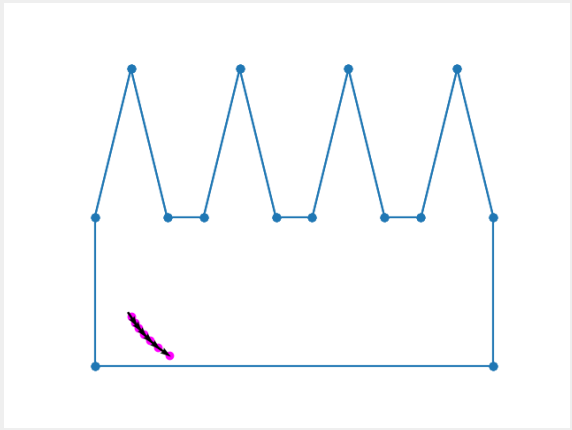
Practice



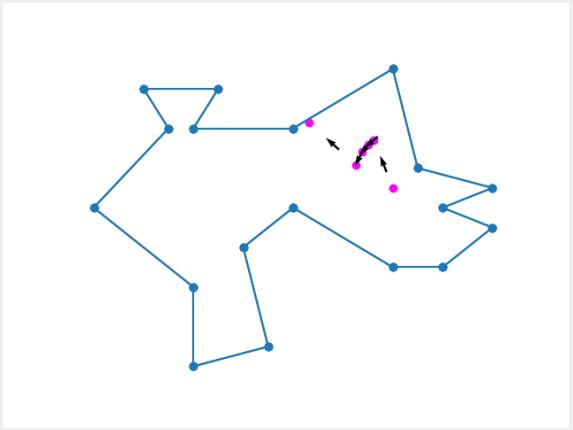
(a)



(b)



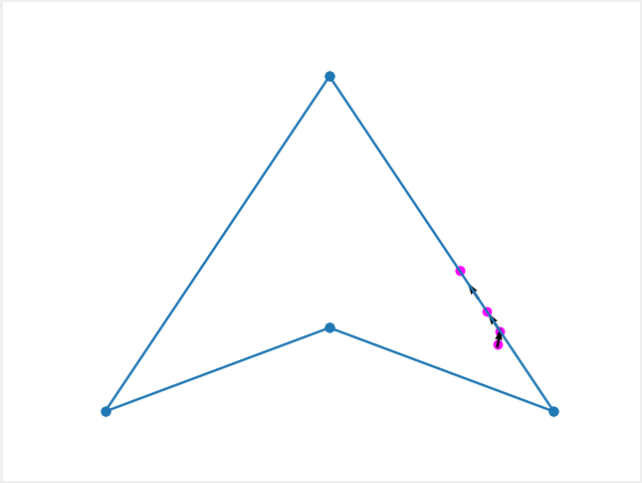
(c)



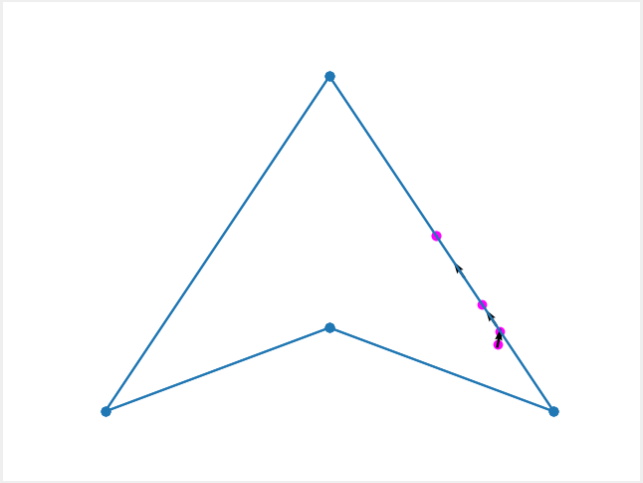
(d)

Figure: Learning rate $\alpha = 0.2$.

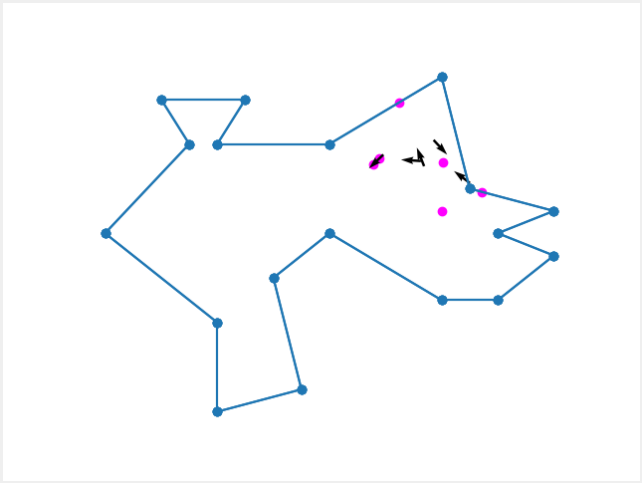
Practice



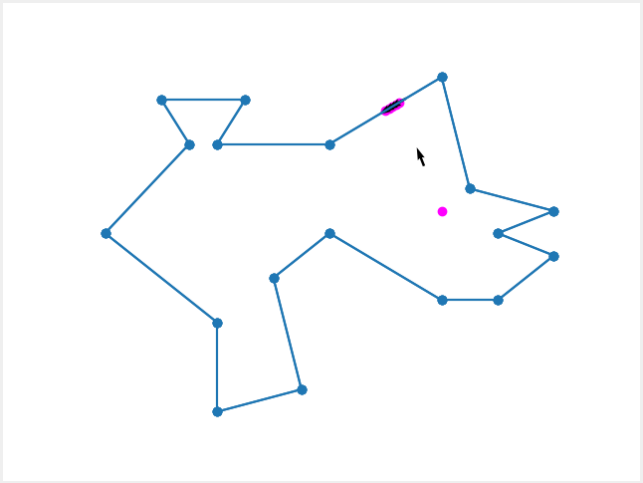
(a) Learning rate $\alpha = 0.45$.



(b) Learning rate $\alpha = 0.6$.



(c) Learning rate $\alpha = 0.45$.



(d) Learning rate $\alpha = 0.6$.

Conclusion and Future Plans

- gradient for multiple guards

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- gradient for multiple guards
- gradient experiments (momentum)

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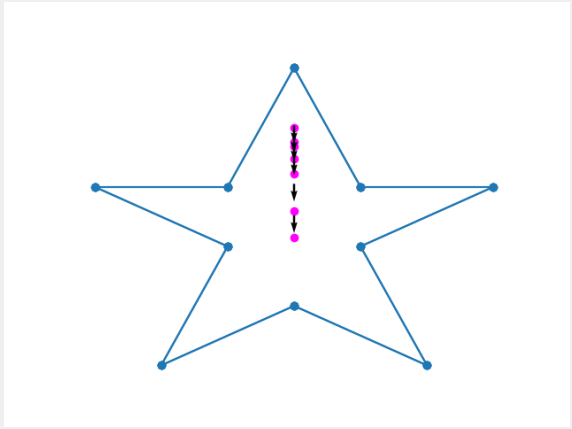
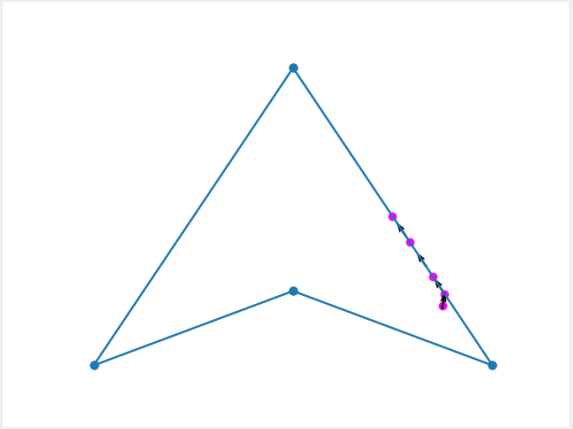
- gradient for multiple guards
- gradient experiments (momentum)
- guard addition strategy
- comparison with existing algorithms [1]

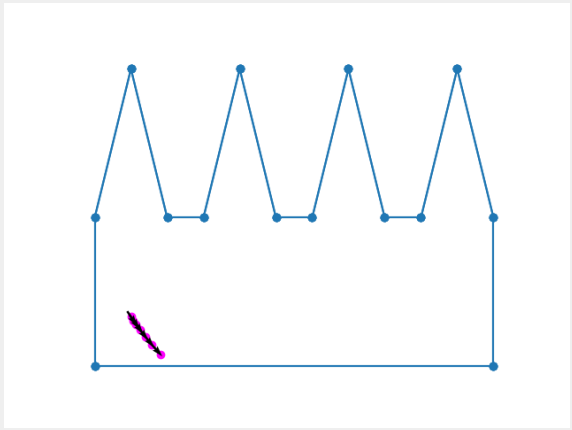
Practice with Momentum



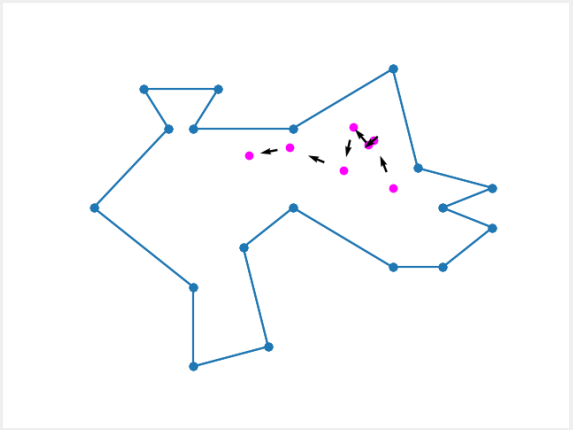
(a)



(b)



(c)



(d)

Figure: Learning rate $\alpha = 0.2$.

References

Simon B. Hengeveld and Tillmann Miltzow.
A practical algorithm with performance guarantees for the art gallery problem.
CoRR, SoCG, abs/2007.06920, 2020.