

Tutorial 4 - Gradient Descent

Kevin Dick, PhDc Biomedical Engineering
Carleton University

Friday 2nd October, 2020

Disclaimer: Recorded Tutorials will be Publicly Posted

Goal: to create a companion series of applied machine learning tutorials for the 100MLB text, these tutorials will be publicly posted as a YouTube playlist.

Privacy Preservation:

- Ask questions in the chat¹.
- Keep video off

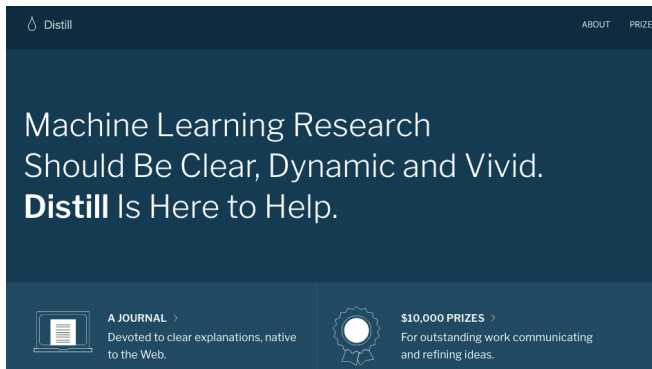
Note: If the above *hinders your ability to learn* \wedge *violates your privacy*, please let me/Dr. Green know ASAP and video will be post-processed accordingly.

¹I encourage unmuted/voice-based questions at any time, but know that this isn't explicitly privacy-preserving

ML Weekly

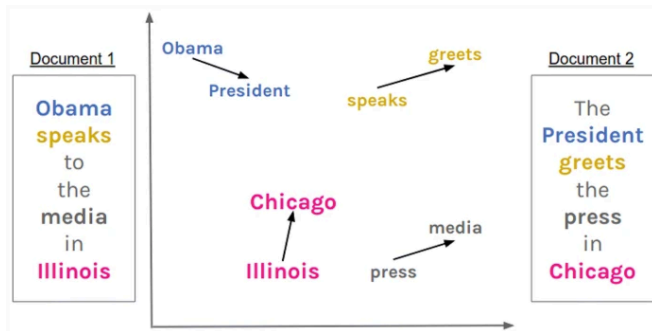
Recent news events from the ML community

1. (ML) Introducing the Distill Journal



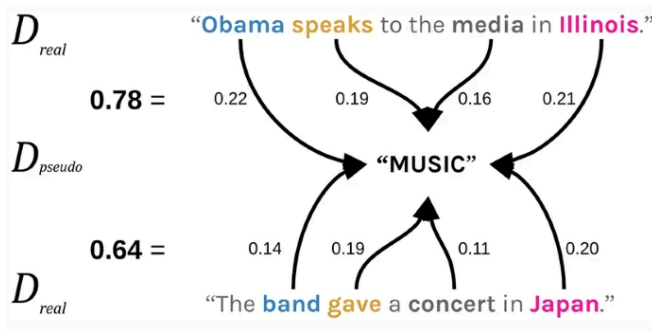
ML Weekly

1. **(ML)** Introducing the Distill Journal
2. **(NLP)** Concept Mover's Distance



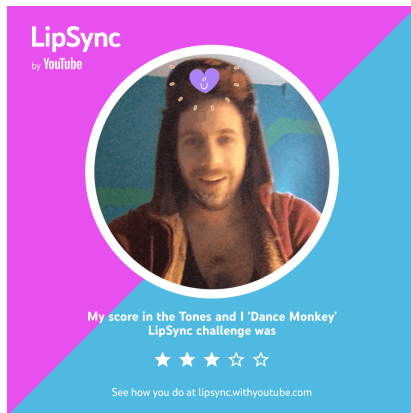
ML Weekly

1. (ML) Introducing the Distill Journal
2. (NLP) Concept Mover's Distance



ML Weekly

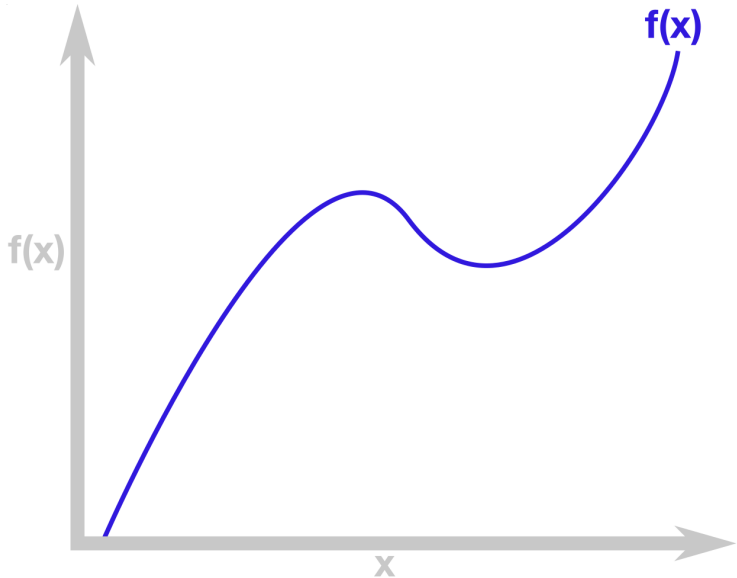
1. **(ML)** Introducing the Distill Journal
2. **(NLP)** Concept Mover's Distance
3. **(Vision)** Google launches AI lip-sync challenge



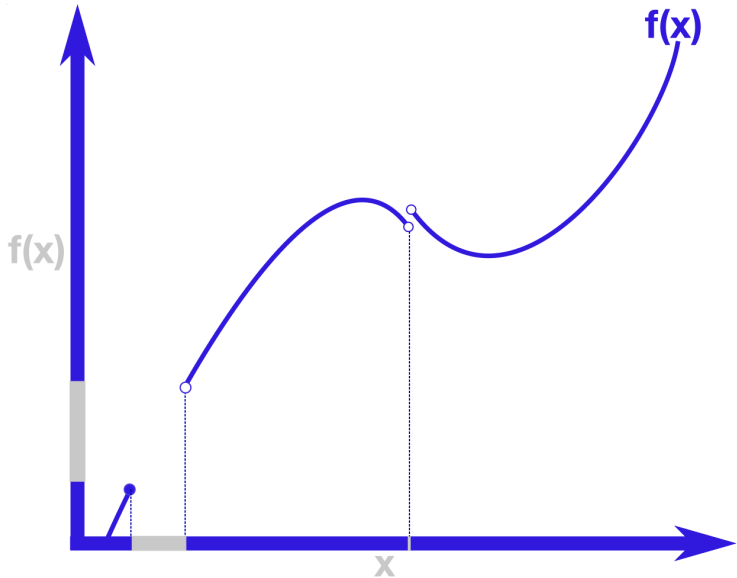
Tutorial Intuition

Building an Intuition for the Concepts of this Tutorial

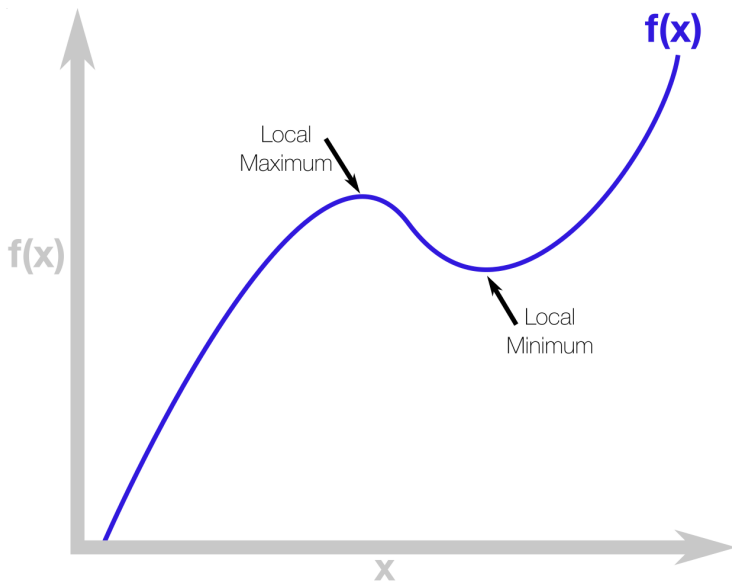
What is Gradient Descent?



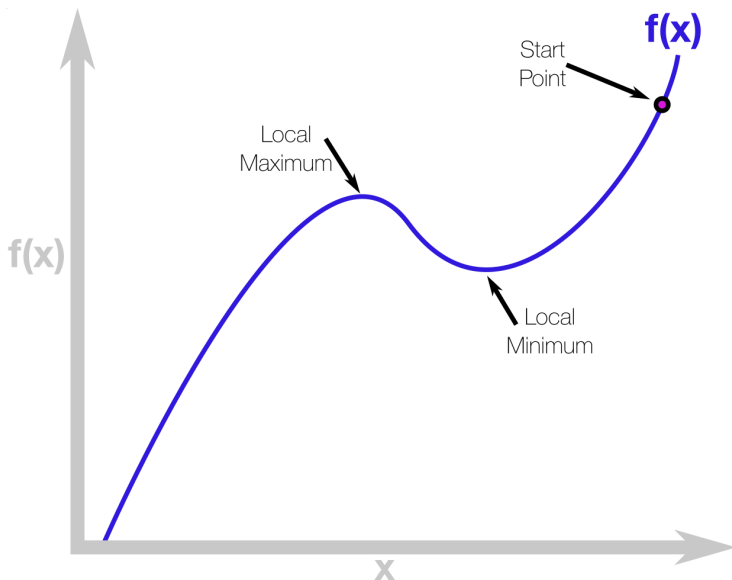
What is Gradient Descent?



What is Gradient Descent?



What is Gradient Descent?

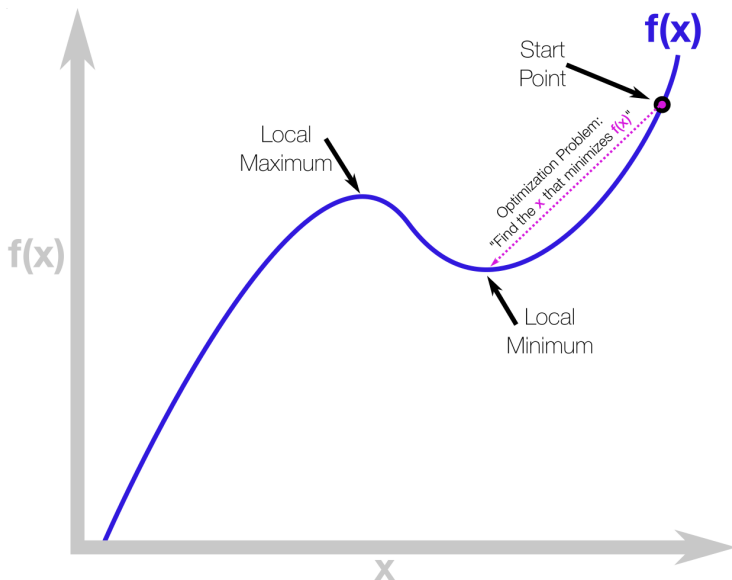


x

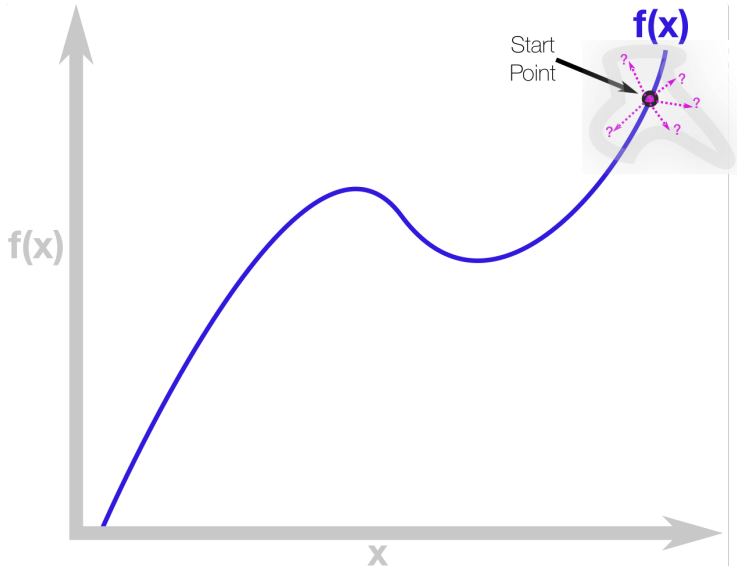
Tutorial 4

Kevin Dick, PhDc Biomedical Engineering, Carleton University

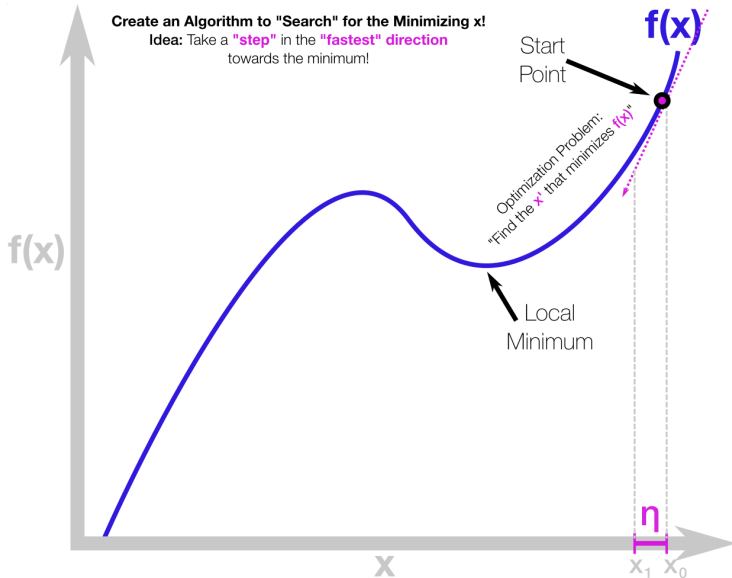
What is Gradient Descent?



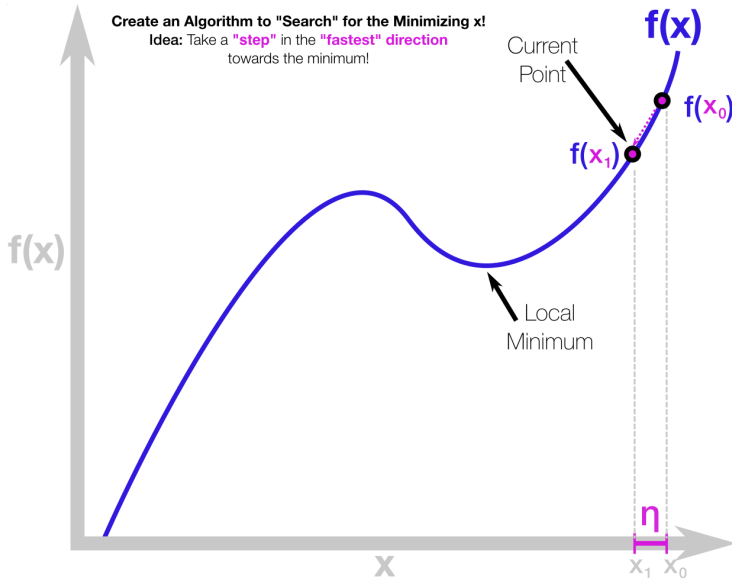
What is Gradient Descent?



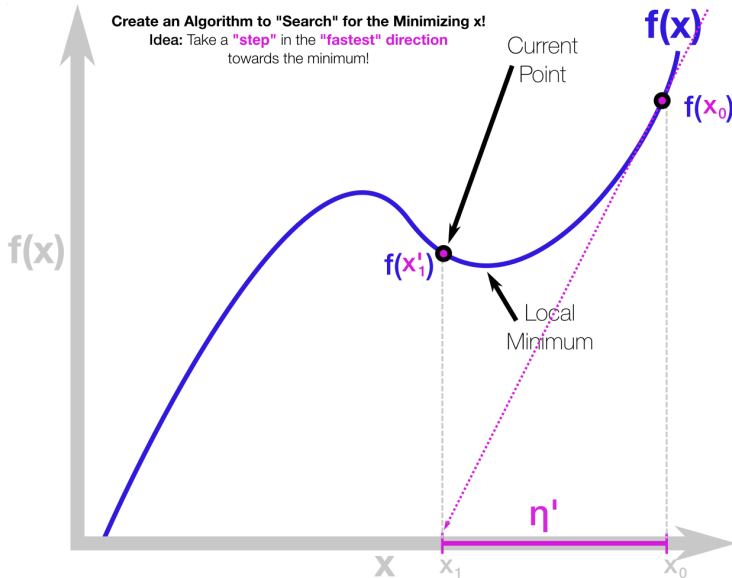
What is Gradient Descent?



What is Gradient Descent?



What is Gradient Descent?



Create an Algorithm to "Search" for the Minimizing x !

Idea: Take a "step" in the "fastest" direction towards the minimum!

Current Point

$f(x)$

$f(x_0)$

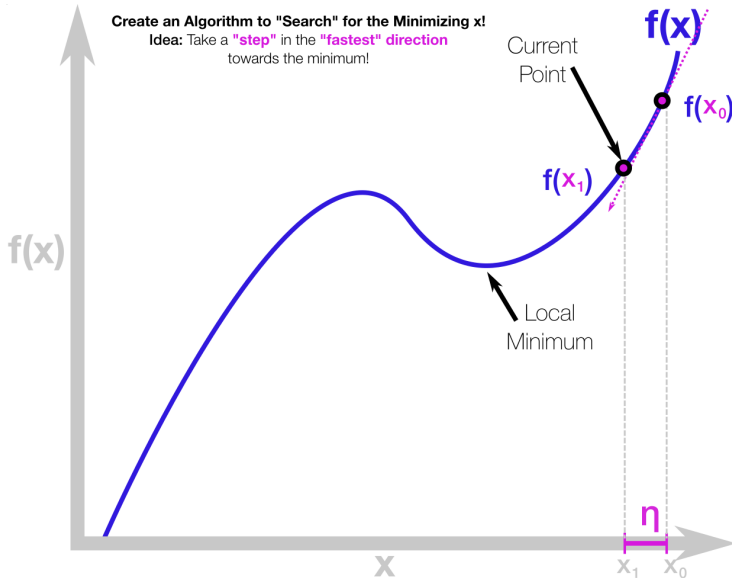
$f(x_1)$

Local Minimum

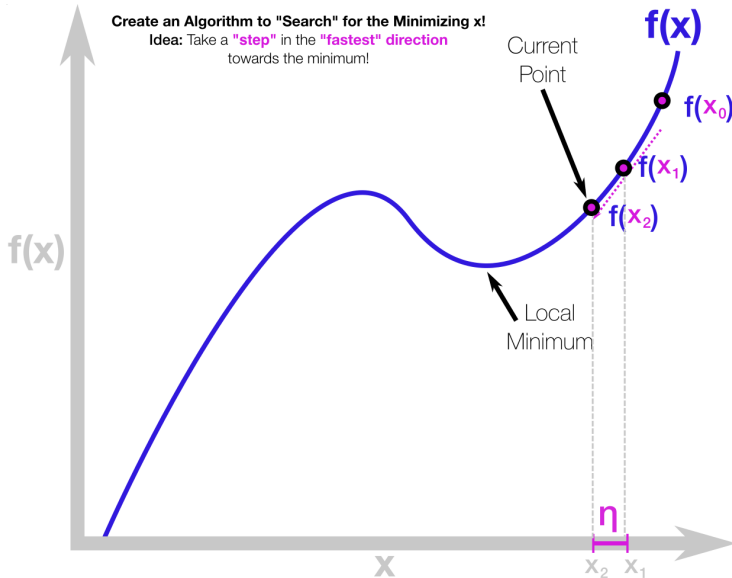
x_1''

x_1, x_0

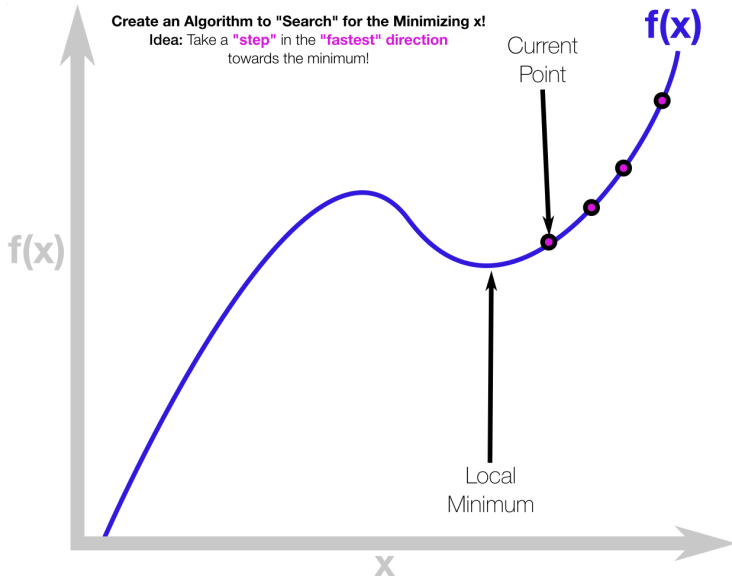
What is Gradient Descent?



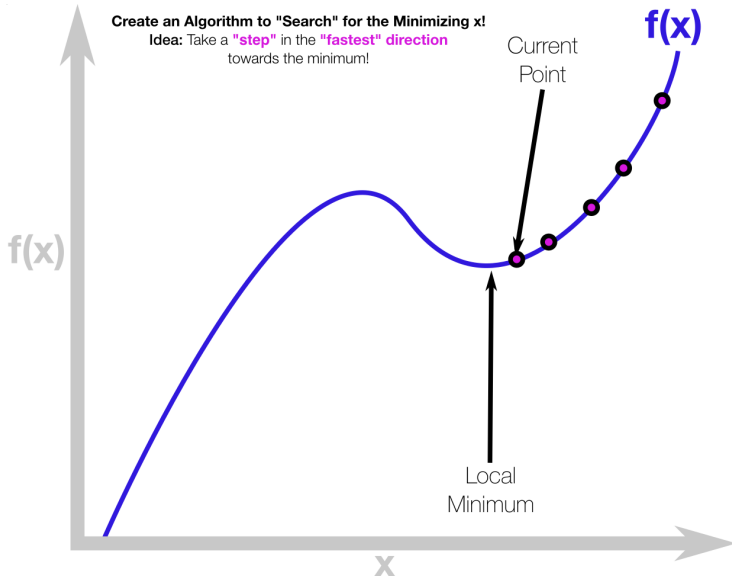
What is Gradient Descent?



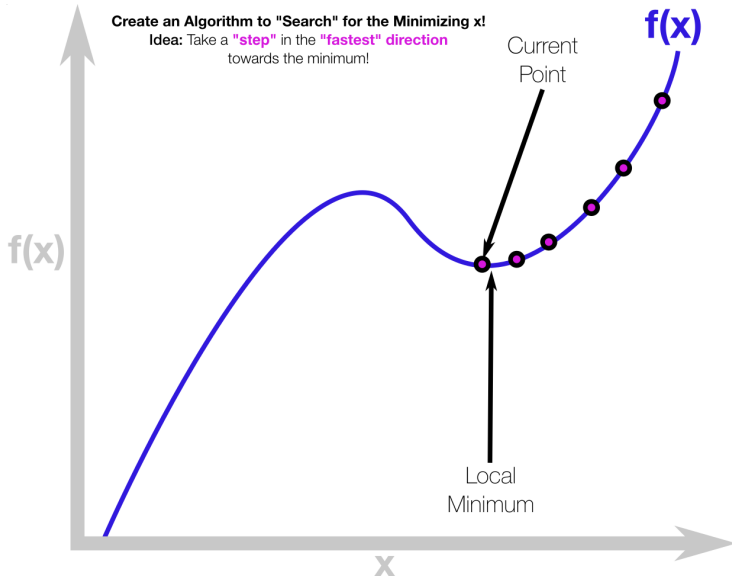
What is Gradient Descent?



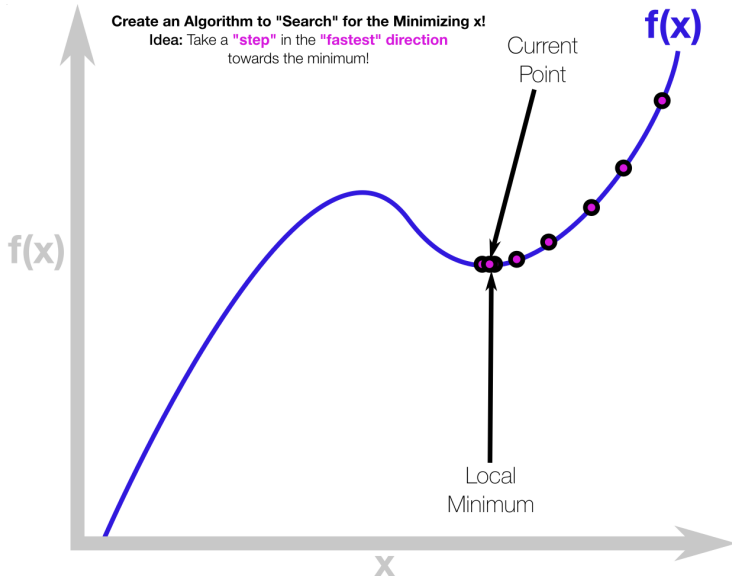
What is Gradient Descent?



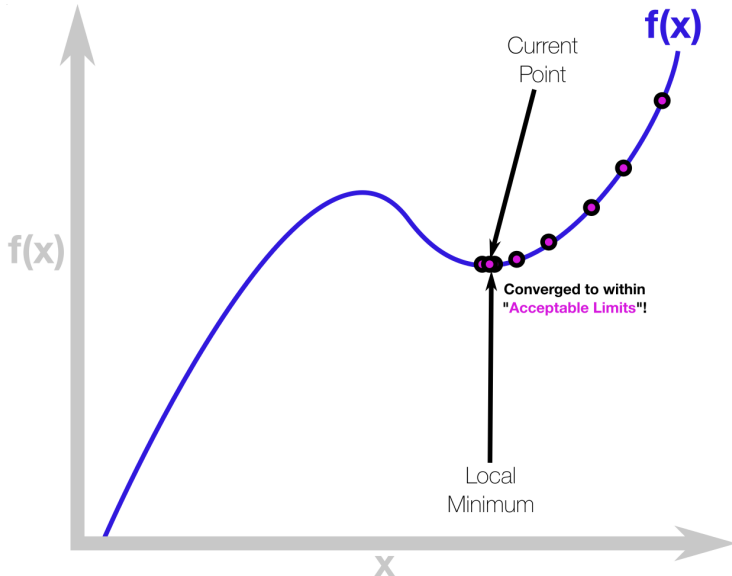
What is Gradient Descent?



What is Gradient Descent?



What is Gradient Descent?



Comparing “Classical” ML Algorithms

In this tutorial, we will implement the *batch gradient descent* algorithm and *stochastic gradient descent*.

Key Takeaway: gradient descent is broadly used in ML algorithms to “learn”/optimize model parameters!



Into the Notebooks we Go...

We will cover one new notebook and (with enough time) cover a second.

1. Tutorial 4 - Gradient Descent
2. Tutorial 4 - Data Imputation

Tutorial 4 - Gradient Descent

Kevin Dick, PhDc Biomedical Engineering
Carleton University

Friday 2nd October, 2020