# Hyperparameter Tuning with Poison Disc Sampling

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## I. Introduction and Background

Neural Networks have become widely popular for classification and regression problems. Much effort has been put into developing new types of Neural Nets such as *CNNs, RNNs, LSTMs* etc. All these Neural Nets need to be tweaked by changing their Hyperparameters, such as *Step Size, Decay Rate, Batch Size etc.*. Performance of Neural Nets is dependant on finding those Hyperparameters. Methods like Random Search and Grid Search attempt to find those Hyperparameters but are too generic. This project is an attempt to find good Hyperparameters using *Poisson Disc sampling*.

### A. Problem Investigation

A problem with existing techniques such as Grid Search, Hexagonal Sampling do not have the edge of *randomness*, as you are able to find patterns within the samples. This is also known as the **The Corn Field Problem** as described by *Erik Learned Miller*. Poisson Disc Sampling is an attempt to solve this problem, while doing a comprehensive search of the Hyperparameter Space.

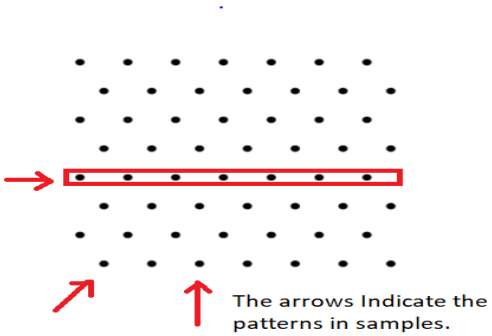


Fig. 1: The Corn Field Problem

### B. Data Set

I will be using CIFAR Data Set to train Neural Net on Images.

### C. Method

The method will be to use Grid Search to find hot spots in the Hyperparameter Space and then apply Poisson Disc Sampling with a constraint for fine tuning. The project will implement the algorithm by Robert Bridson for Poisson Disc sampling in arbitrary space. This algorithm can generate Poisson Disc samples in $O(n)$ time complexity.

### D. Readings

I will base my project on the following papers.

1) Fast Poisson Disk Sampling in Arbitrary Dimensions, Robert Bridson, University of British Columbia.
2) A Spatial Data Structure for Fast Poisson-Disk Sample Generation, Daniel Dunbar and Greg Humphreys.
3) Adaptive Sampling with Polyominoes.

## II. Performance Metric

The metric for estimating the performance will be decided by the following.

1) Improvement in *accuracy*.
2) How much *time and computation* did the tuning technique take when compared to others such as *Grid Search, Random Search, Manual Tuning etc.*

Figures and Graphs will be provided to understand the performance of Poisson Disc sampling relative to other methods.

## References

[1] Robert Bridson *Fast Poisson Disk Sampling in Arbitrary Dimensions.* University of British Columbia.

[2] Daniel Dunbar et al. *A Spatial Data Structure for Fast Poisson-Disk Sample Generation.* University of Virginia.