**Ultimate Objective**

Confine light in volume.

Below, each set is an example of an output from a single experiment

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample Set1**   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | | **Image** | **distance** | **sharpness** | **bluriness** | | A | d1 | 1 | 0 | | B | d2 | 0.5 | 0.5 | | C | d3 | 0.1 | 0.9 | |
| **Sample Set2**   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | | **Image** | **distance** | **sharpness** | **bluriness** | | A | d1 | 0.7 | 0.3 | | B | d2 | 0.5 | 0.5 | | C | d3 | 0.5 | 0.5 | |
| **Ideal Set**   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | | **Image** | **distance** | **sharpness** | **bluriness** | | A | d1 | 1 | 0 | | B | d2 | 1 | 0 | | C | d3 | 1 | 0 | |

**Sub Objectives**

1. Write simple genetic algorithm to optimize **one** image
2. Test on initially blurry image to check if GA is performing as expected (making image sharp)
3. Add 3 image (plane) optimization and work on fitness function
4. System should converge to Bessel beam if optimized **only** on property1 (similarity between planes)
5. Combine different sets of properties
   1. Similarity between planes
   2. Size of laser beam
   3. Maximum of peaks
6. Create line focus

**Experiment Process**

1. Send phase SLM (“virtually” deforms surface via LabView)
2. Laser reflects on SLM
3. Phase affects profile (light structure)
4. Camera measures profile (structure, distribution)
5. Fitness function evaluates camera measurements
6. Most “fit” measurements are logged back into set of potential solutions and hybridized.
   1. Potential criteria for evaluation include (not limited to):
      1. Similarity of elements in a set of planes
      2. Size of beam
      3. Max and peak
   2. Each criteria given a weight.

**Purpose of each component**

1. Spatial Light Modulator (SLM) – Reflective LCD screen whose pixels are controlled by program to control *how* light will reflect.
2. Phase – a single configuration of SLM
3. Genetic algorithm
   1. Fitness Function
   2. Mutation
   3. Solutions (Population)