Computational Eigenvector Simulation

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Example 1: A Symmetric Stochastic Matrixx

Step 0: Setup the matrix

```
# Set seed
set.seed(23)
# Set parameters
M <- 2
mu <- 0
sd <- 1
# Generate matrix
P <- RM_stoch(M, symm = T, sparsity = F)
```

The Matrix

```
##           [,1]      [,2]
## [1,] 0.5977228 0.4196847
## [2,] 0.4196847 0.5660087
```

Eigenvalues of the Symmetric Stochastic Matrix

```
eigen_frame(P)
```

```
##         Re Im row_i
## 1 -0.72033  0     1
## 2  0.69363  0     1
## 3 -0.69363  0     2
## 4 -0.72033  0     2
```

Step 1: Get the batch

```
# Set batch parameters
B <- 100
# Create batch
batch <- make_batch(M = M, B = B)
head(batch)
```

```
##           x1         x2
## 1  0.6388979 -0.1525589
## 2  0.9270891  0.9562608
## 3  0.6810438  0.9932225
## 4  0.7319181  0.4028434
## 5 -0.2190539 -0.3704606
## 6  0.6918946 -0.7214430
```

Step 2: Evolve the batch

```r
# Set evolution parameters
steps <- 20
# Evolve batch
evolved_batch <- evolve_batch(batch, steps)
# Add indexing to the batch
evolved_batch <- indexed_batch(evolved_batch, steps)
head(evolved_batch)
```

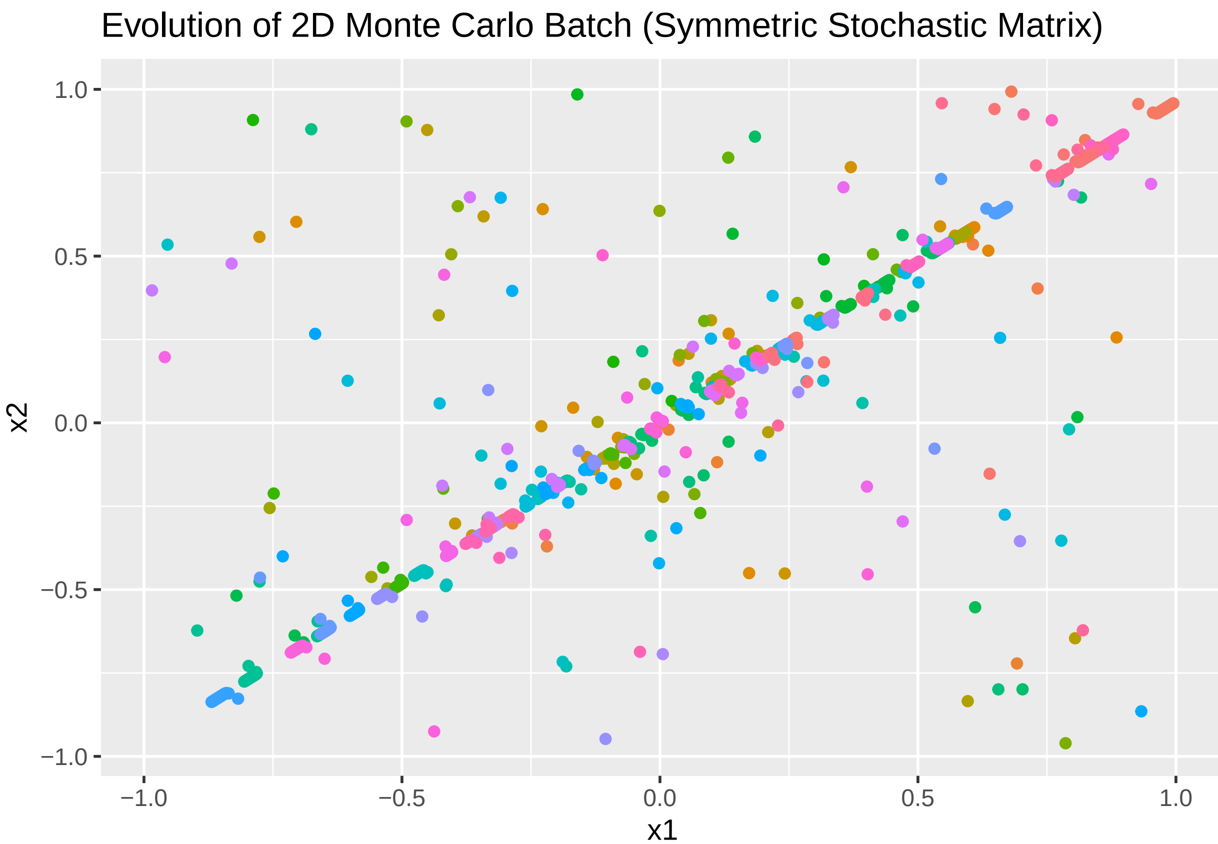
```
##          x1         x2 index_column
## 1 0.6388979 -0.1525589            1
## 2 0.3178572  0.1817860            1
## 3 0.2662833  0.2362923            1
## 4 0.2583318  0.2454985            1
## 5 0.2574428  0.2473722            1
## 6 0.2576977  0.2480596            1
```

```r
tail(evolved_batch)
```

```
##             x1        x2 index_column
## 2095 0.8292696 0.7985288          100
## 2096 0.8308036 0.8000060          100
## 2097 0.8323405 0.8014859          100
## 2098 0.8338802 0.8029685          100
## 2099 0.8354228 0.8044539          100
## 2100 0.8369682 0.8059420          100
```

Step 3: Analyze the batch

```r
# Plot the evolution arrays of the batch elements
batch_data <- evolved_batch
# 2d plot
batch_2d_plot(batch_data, "(Symmetric Stochastic Matrix)")
```



Example 2: A Symmetric Normal Matrix

Step 0: Setup the matrix

```r
# Set seed
set.seed(6)
# Set parameters
M <- 3
mu <- 0
sd <- 1
# Generate matrix
P <- RM_normal(M, c(mu,sd), symm = T)
```

The Matrix

```
##            [,1]       [,2]      [,3]
## [1,]  1.2241389  0.7701131 -0.779311
## [2,]  0.7701131  3.1192319 -2.226872
## [3,] -0.7793110 -2.2268719  2.261592
```

The Eigenvalues

```r
eigen_frame(P)
```

```
##         Re Im row_i
## 1 -0.26130  0     1
## 2  0.94585  0     1
## 3  0.19260  0     1
## 4 -0.74046  0     2
## 5 -0.32442  0     2
## 6  0.58862  0     2
## 7  0.61923  0     3
## 8  0.01119  0     3
## 9  0.78513  0     3
```

Step 1: Get the batch

```r
# Set batch parameters
B <- 100
# Create batch
batch <- make_batch(M = M, B = B)
head(batch)
```

```
##            x1         x2         x3
## 1 -0.70554436  0.4010521  0.9159851
## 2  0.65725012 -0.7614424 -0.5193180
## 3  0.48637698 -0.3684048 -0.2875491
## 4  0.82871976 -0.4511969 -0.1333239
## 5  0.04354699 -0.7476617  0.9123038
## 6  0.52000557 -0.7262086  0.8617301
```

Step 2: Evolve the batch

```r
# Set evolution parameters
steps <- 20
# Evolve batch
evolved_batch <- evolve_batch(batch, steps)
# Add indexing to the batch
evolved_batch <- indexed_batch(evolved_batch, steps)
head(evolved_batch)
```

```
##             x1            x2           x3 index_column
## 1   -0.7055444     0.4010521    0.9159851            1
## 2   -1.2686661    -1.3321558    1.7283312            1
## 3   -3.9258416    -8.9810916    7.8640056            1
## 4  -17.8507374   -48.5495824   40.8443626            1
## 5  -91.0709107  -256.1396562  214.3982528            1
## 6 -475.8228565 -1346.5313329 1126.2440984            1
```

```r
tail(evolved_batch)
```

```
##                 x1            x2           x3 index_column
## 2095 -1.899260e+10 -5.382055e+10 4.500893e+10          100
## 2096 -9.977344e+10 -2.827343e+11 2.364444e+11          100
## 2097 -5.241377e+11 -1.485282e+12 1.242108e+12          100
## 2098 -2.753441e+12 -7.802602e+12 6.525142e+12          100
## 2099 -1.446460e+13 -4.098924e+13 3.427839e+13          100
## 2100 -7.598655e+13 -2.153279e+14 1.800739e+14          100
```

Step 3: Analyze the batch

```r
# Plot the evolution arrays of the batch elements
batch_data <- evolved_batch
# 3d plot
batch_3d_plot(batch_data, "(Symmetric Normal Matrix)")
```