

Random Matrix Analysis

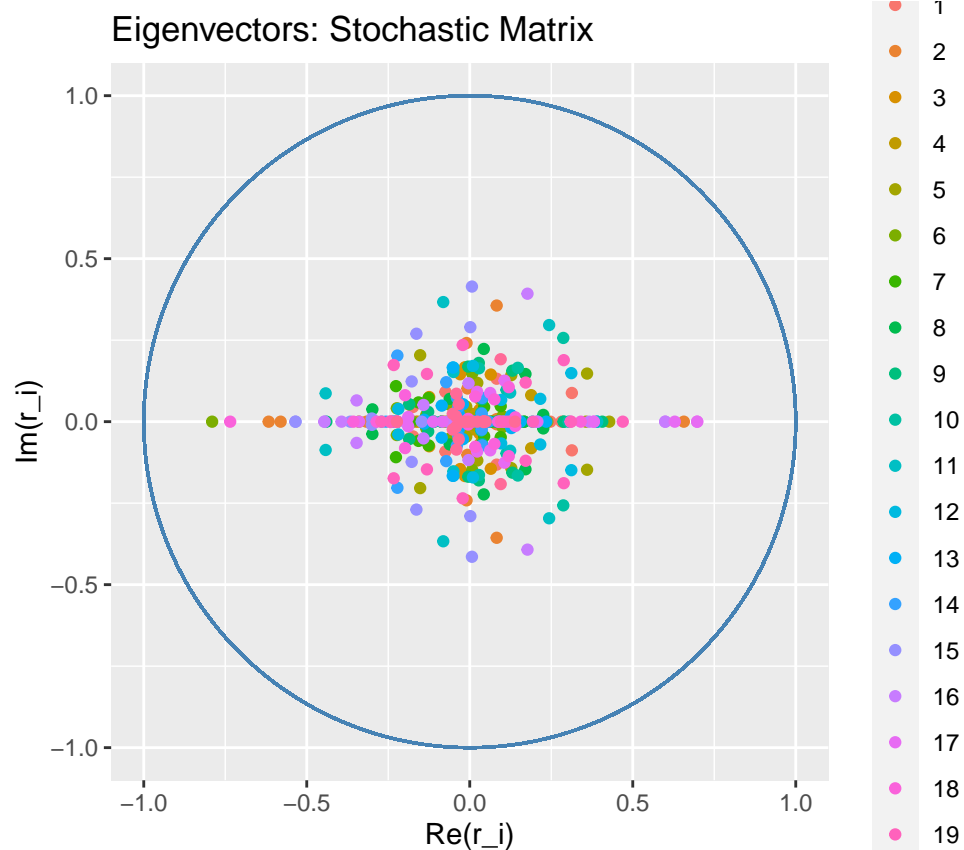
Ali Taqi

```
bool_plot <- T  
M <- 20
```

Eigenmetrics of Various Random Matrices

Stochastic Matrix

```
set.seed(1)  
P <- rand_M_stoch(M, row_fn = r_zeros)  
if(bool_plot){eigen_plot(P, loud = T, "Stochastic")}
```



```
eigen_summary(eigen_frame(P))
```

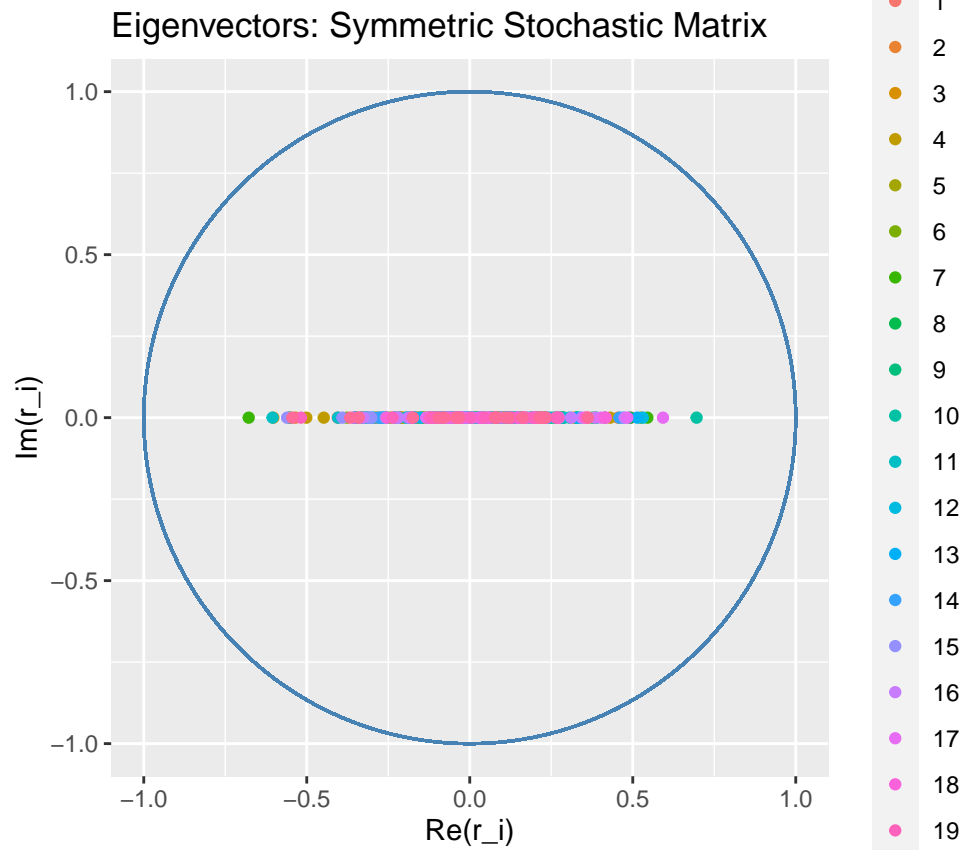
```
## # A tibble: 20 x 3  
##   row_i prop_reals is_real  
##   <dbl>      <dbl> <lgl>
```

```
## 1      1      0.4 FALSE
## 2      2      0.4 FALSE
## 3      3      0.4 FALSE
## 4      4      0.4 FALSE
## 5      5      0.4 FALSE
## 6      6      0.4 FALSE
## 7      7      0.4 FALSE
## 8      8      0.4 FALSE
## 9      9      0.4 FALSE
## 10     10     0.4 FALSE
## 11     11     0.5 FALSE
## 12     12     0.4 FALSE
## 13     13     0.4 FALSE
## 14     14     0.4 FALSE
## 15     15     0.5 FALSE
## 16     16     0.6 FALSE
## 17     17     0.6 FALSE
## 18     18     0.4 FALSE
## 19     19     0.4 FALSE
## 20     20     0.4 FALSE

## [1] "Proportion of real-valued rows: 0"
```

Symmetric Stochastic Matrix

```
set.seed(23)
P <- rand_M_symm_stoch(M, row_fn = r_zeros)
if(bool_plot){eigen_plot(P, loud = T, "Symmetric Stochastic")}
```



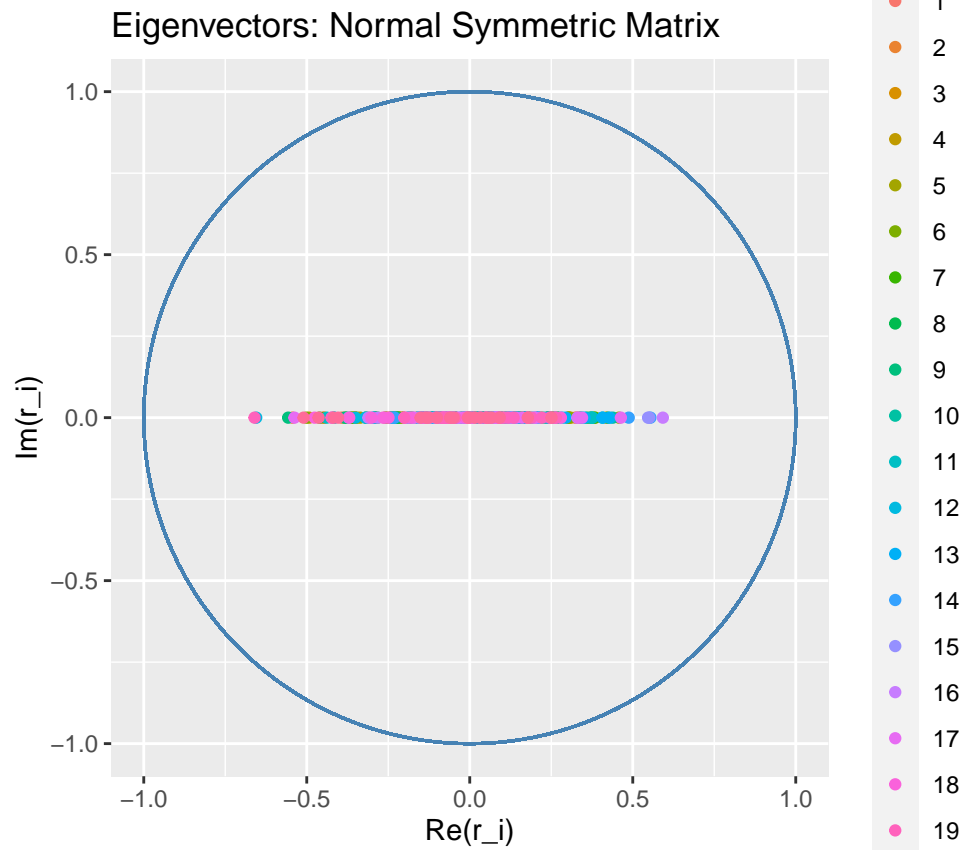
```
eigen_summary(eigen_frame(P))
```

```
## # A tibble: 20 x 3
##   row_i prop_reals is_real
##   <dbl>     <dbl> <lgl>
## 1     1         1 TRUE
## 2     2         1 TRUE
## 3     3         1 TRUE
## 4     4         1 TRUE
## 5     5         1 TRUE
## 6     6         1 TRUE
## 7     7         1 TRUE
## 8     8         1 TRUE
## 9     9         1 TRUE
## 10    10         1 TRUE
## 11    11         1 TRUE
## 12    12         1 TRUE
## 13    13         1 TRUE
## 14    14         1 TRUE
## 15    15         1 TRUE
## 16    16         1 TRUE
```

```
## 17    17          1 TRUE
## 18    18          1 TRUE
## 19    19          1 TRUE
## 20    20          1 TRUE
## [1] "Proportion of real-valued rows: 1"
```

Normal Symmetric Matrix

```
set.seed(23)
P <- rand_M_symm_norm(M, mu = 0, sd = 1)
if(bool_plot){eigen_plot(P, loud = F, "Normal Symmetric")}
```



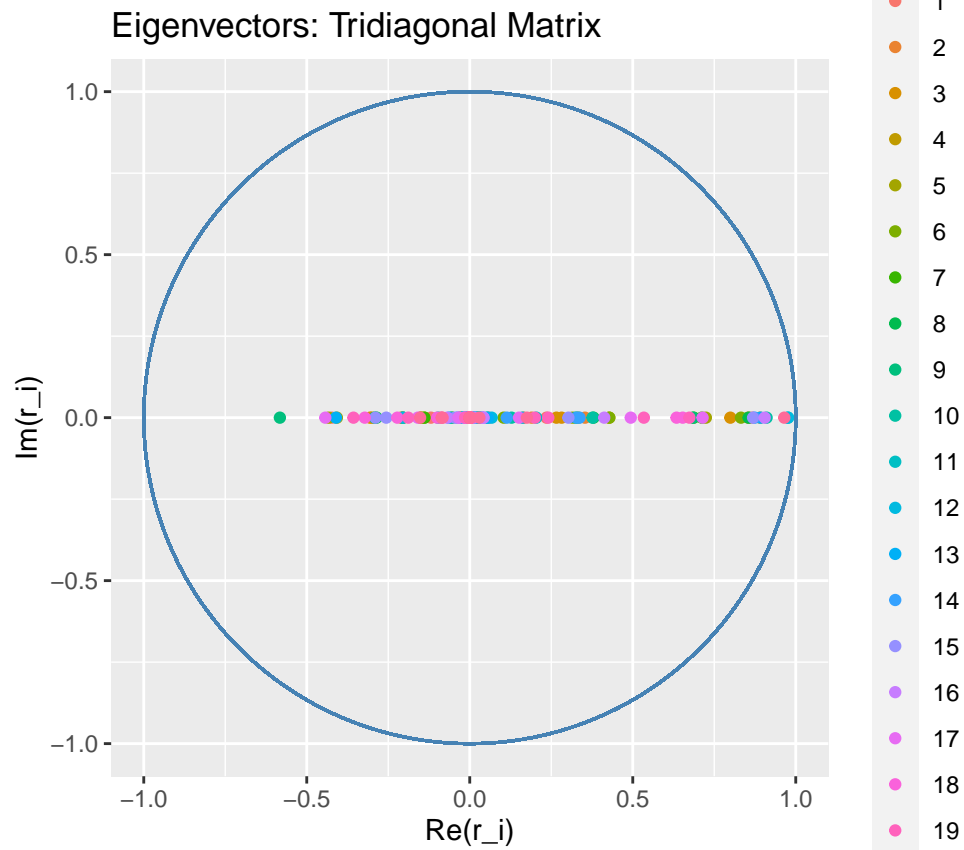
```
eigen_summary(eigen_frame(P))
```

```
## # A tibble: 20 x 3
##   row_i prop_reals is_real
##   <dbl>     <dbl> <lgl>
## 1     1         1 TRUE
## 2     2         1 TRUE
## 3     3         1 TRUE
## 4     4         1 TRUE
## 5     5         1 TRUE
## 6     6         1 TRUE
## 7     7         1 TRUE
## 8     8         1 TRUE
## 9     9         1 TRUE
## 10    10         1 TRUE
## 11    11         1 TRUE
## 12    12         1 TRUE
## 13    13         1 TRUE
## 14    14         1 TRUE
## 15    15         1 TRUE
## 16    16         1 TRUE
```

```
## 17    17          1 TRUE
## 18    18          1 TRUE
## 19    19          1 TRUE
## 20    20          1 TRUE
## [1] "Proportion of real-valued rows: 1"
```

Tridiagonal Matrix

```
set.seed(23)
P <- rand_M_trid(M)
if(bool_plot){eigen_plot(P, loud = F, "Tridiagonal")}
```



```
eigen_summary(eigen_frame(P))
```

```
## # A tibble: 20 x 3
##   row_i prop_reals is_real
##   <dbl>     <dbl> <lgl>
## 1     1         1 TRUE
## 2     2         1 TRUE
## 3     3         1 TRUE
## 4     4         1 TRUE
## 5     5         1 TRUE
## 6     6         1 TRUE
## 7     7         1 TRUE
## 8     8         1 TRUE
## 9     9         1 TRUE
## 10    10         1 TRUE
## 11    11         1 TRUE
## 12    12         1 TRUE
## 13    13         1 TRUE
## 14    14         1 TRUE
## 15    15         1 TRUE
## 16    16         1 TRUE
```

```
## 17      17          1 TRUE
## 18      18          1 TRUE
## 19      19          1 TRUE
## 20      20          1 TRUE

## [1] "Proportion of real-valued rows: 1"
```

Analysis of p-Sparse Stochastic Matrices (Erdos-Renyi Graphs)