Caswell Twombly Method

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Note

Adapted from Caswell and Twombly(1989). From page 143 in Caswell book. This method is extremely sensitive to noise.

$$\begin{bmatrix} -0.674640895717635 & 0 & 0 & 33.2019818432295 \\ 0.32775138055123 & 0.0161690702608959 & 0 & 0 \\ 0 & 0.227417221751642 & 0.658118894358319 & 0 \\ 0 & 0 & 0.113526262436981 & -0.34649495551895 \end{bmatrix}$$

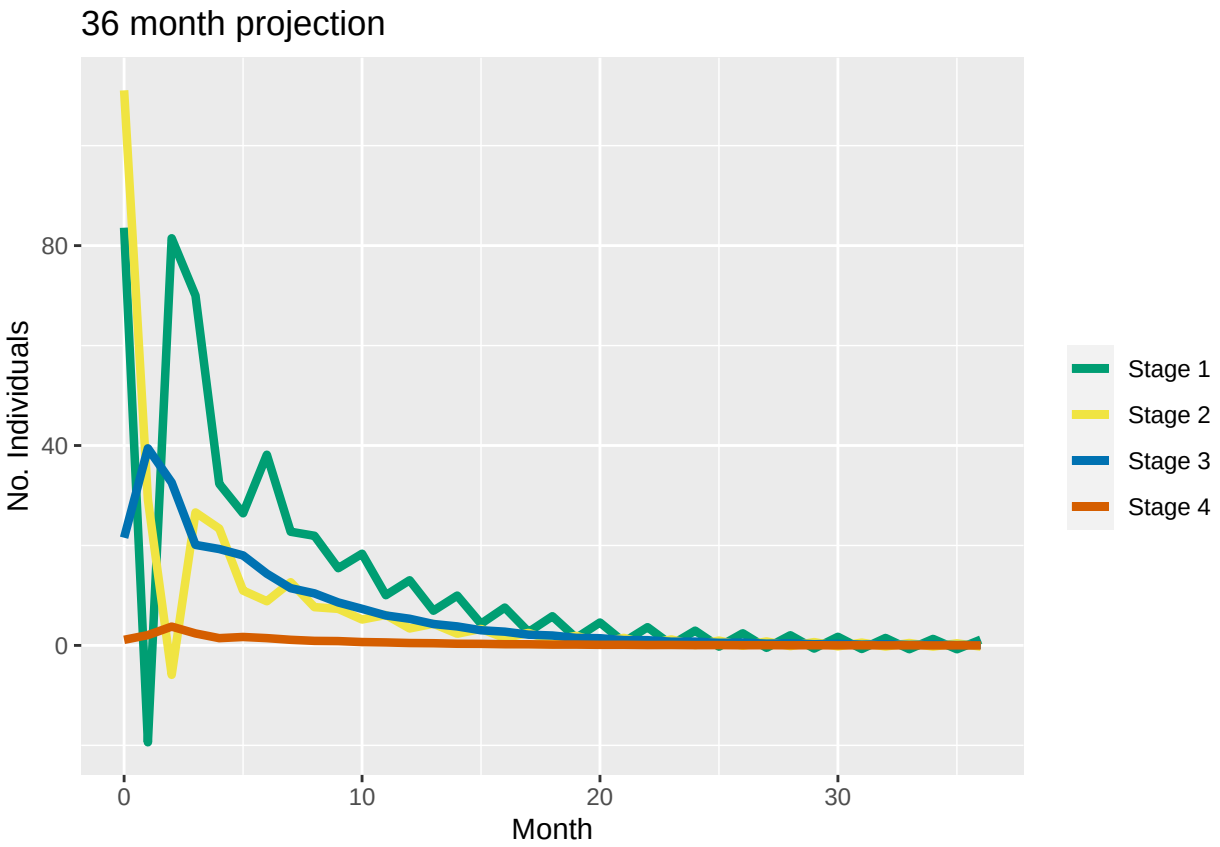
```
pop <- observedStageMatrix[13,]
N <- list()

#12 mo projection
for (i in 1:36){
     N[[1]] <- pop
    N[[i+1]] <- A %*% N[[i]]
 }

modeled_data <- t(as.data.frame(do.call(cbind, N)))
colnames(modeled_data) <- c("Stage_1", "Stage_2", "Stage_3", "Stage_4")
modeled_data <- cbind(modeled_data, month = 0:36)

#write.csv(modeled_data, "testing.csv",row.names = TRUE)
modeled_data <- data.frame(modeled_data)

print(ggplot(modeled_data) +
  geom_line(aes(y = Stage_1, x = month, color = "Stage 1"), size = 1.5) +
  geom_line(aes(y = Stage_2, x = month, color= "Stage 2"), size = 1.5) +
  geom_line(aes(y = Stage_3, x = month, color = "Stage 3"), size = 1.5) +
  geom_line(aes(y = Stage_4, x = month, color= "Stage 4"), size = 1.5) +
  scale_color_manual(name = "", values = c("Stage 1" = "#009E73",
                                           "Stage 2" = "#F0E442",
                                           "Stage 3" = "#0072B2",
                                           "Stage 4" = "#D55E00")) +
  ggtitle(paste0(i, " month projection")) +
  xlab("Month") +
  ylab("No. Individuals"))
```


36 month projection
No. Individuals
80
40
0
0
10
20
30
Month
Stage 1
Stage 2
Stage 3
Stage 4