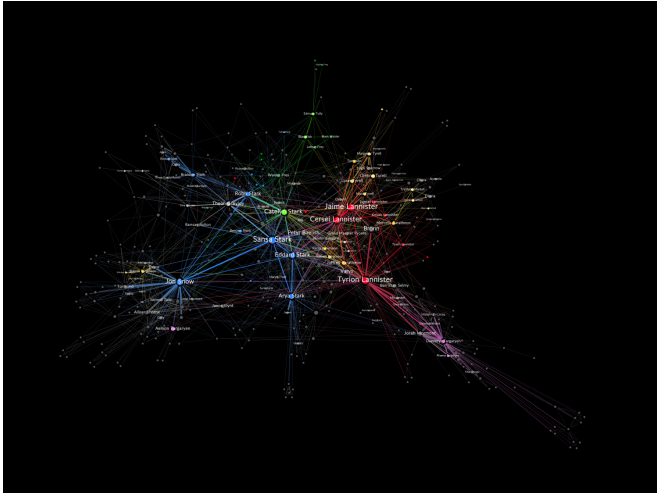


Researcher builds 'Game of Thrones' network model to predict character deaths

22 July 2017, by Christopher Packham



Credit: Milan Janosov

(TechXplore)—"The man who passes the sentence should swing the sword," says Lord Eddard Stark, the head of House Stark, the Lord of Winterfell, Lord Paramount and Warden of the North, and Hand of the King to King Robert I Baratheon on HBO's *Game of Thrones*, on the subject of public execution. "If you would take a man's life, you owe it to him to look into his eyes and hear his final words. And if you cannot bear to do that, then perhaps the man does not deserve to die."

In the spirit of personally swinging the sword, Milan Janosov, a Ph.D. candidate at the Center for Network Science of Central European University, built a network of the relationships between the 94 major characters on *Game of Thrones* in order to determine the probability that they will die during the final two seasons.

Janosov's data source was the series subtitle transcriptions. In his Westeros network map, each node represents a character from the show. Janosov considered scenes as "the elementary

unit of social interaction," and connections between characters were weighted according to their interactions—for the characters within an individual interaction, the connection between them had a strength of one. Within a scene, everyone is connected to everyone else. "In other words," Janosov writes, "scenes are complete graphs, or cliques, increasing the tie strength between all pairs of people present by one."

The final map had nearly 400 nodes and 3000 edges. Interestingly, the map visualization reveals important character functions within the series. For instance, Tyrion Lannister connects Daenerys Targaryen to the center of the network, where large communities of characters center around King's Landing. Here, the connections between nodes create a dense web of relationships between allied and opposing houses that comprise the core of the plot.

| | degree | weighted degree | pageranks | clustering | eigencentality | closenesscentrality | betweennesscentrality | died |
|-------------------|--------|-----------------|-----------|------------|----------------|---------------------|-----------------------|------|
| Joffrey Baratheon | 34 | 73 | 0.010648 | 0.567251 | 0.516207 | 0.510730 | 0.005207 | 1.0 |
| Benjen Stark | 23 | 34 | 0.007571 | 0.651515 | 0.411720 | 0.508547 | 0.009492 | 1.0 |
| Theon Greyjoy | 43 | 155 | 0.013937 | 0.324111 | 0.507033 | 0.548387 | 0.030976 | 0.0 |
| Jon Snow | 74 | 374 | 0.024013 | 0.240216 | 0.698632 | 0.595000 | 0.122631 | 0.0 |
| Melisandre | 15 | 59 | 0.005920 | 0.535714 | 0.106703 | 0.399329 | 0.000965 | 0.0 |

Table 1: the set of features (based on network analysis) and the target variable (whether a certain character died over the first six seasons or not) for six randomly selected characters. Credit: Milan Janosov

Having assembled this network map, Janosov sought to determine the likelihood of all the living characters dying by comparing their features to the 61 characters who already died in previous seasons. "This problem resembles the well-known churn problem, which can be solved with various classification-based algorithms," he writes. Janosov used a support vector machine (SVM), a supervised learning model that uses learning

algorithms for classification and regression analysis.

Probabilistic Spoilers: The Top Five Characters Most Likely to Die

Janosov provides a chart with dozens of major characters ranked according to the likelihood that they will die, according to the SVM model.

Tyene Sand, bastard daughter of Prince Oberyn Martell, is the most likely to perish, with a probability of 0.95. As the second likeliest to die, incredibly, the model selects audience favorite Daenerys Targaryen with a probability of 0.91. Third, the soulful, courageous Grey Worm, commander of the Unsullied, is predicted to die with a probability of 0.90. Fourth, Lord Robin Arryn, who likes to "make people fly" by tossing them out of the mountain fortress called the Aerie, and who is probably extremely healthy if contemporary findings about breastfeeding are accurate, is predicted to die with a probability of 0.90. And fifth: Sweet, brave Podrick Payne, squire to Tyrion Lannister and later to Brienne of Tarth, is predicted to die with 0.90 probability, tied with Robin Arryn, who is seriously one of the creepiest characters on television.

Other interesting findings: The model finds that Tyrion Lannister has only a 0.52 chance of dying, but he is likelier to meet his end than the reptilian Petyr Baelish, at 0.50. The least likely of the major characters to die according to the model is Theon "Reek" Greyjoy, whose path to redemption is exceedingly unclear absent a life-sacrificing heroic moment.

| | Probability | Error |
|---------------------------|-------------|-------|
| Tyene | 0.95 | 0.04 |
| Daenerys Targaryen | 0.91 | 0.05 |
| Grey Worm | 0.90 | 0.05 |
| Robin Arryn | 0.90 | 0.06 |
| Podrick | 0.88 | 0.06 |
| Edmure Tully | 0.88 | 0.06 |
| Greatjon Umber | 0.88 | 0.06 |
| Jaqen | 0.87 | 0.06 |
| Bronn | 0.85 | 0.09 |
| Arya Stark | 0.84 | 0.07 |
| Sandor Clegane | 0.83 | 0.07 |
| Brienne | 0.81 | 0.07 |
| Melisandre | 0.80 | 0.07 |
| Olenna Tyrell | 0.79 | 0.09 |
| Yara Greyjoy | 0.74 | 0.07 |
| Daario Naharis | 0.72 | 0.09 |
| Jaime Lannister | 0.67 | 0.11 |
| Gendry | 0.65 | 0.13 |
| Brandon Stark | 0.64 | 0.12 |
| Sansa Stark | 0.59 | 0.11 |
| Varys | 0.56 | 0.12 |
| Tyrion Lannister | 0.52 | 0.12 |
| Petyr Baelish | 0.50 | 0.14 |
| Qyburn | 0.50 | 0.11 |
| Jon Snow | 0.45 | 0.10 |
| Dolorous Edd | 0.45 | 0.11 |
| Gilly | 0.37 | 0.12 |
| Samwell Tarly | 0.35 | 0.14 |
| Cersei Lannister | 0.35 | 0.16 |
| Davos | 0.32 | 0.08 |
| Missandei | 0.28 | 0.10 |
| Obara | 0.25 | 0.08 |
| Tormund | 0.14 | 0.08 |
| Jorah Mormont | 0.05 | 0.06 |
| Theon Greyjoy | 0.05 | 0.06 |

Table 2: Game of Thrones characters and their probability of dying based on their network centrality patterns, and the error of these probabilities based on repeating the prediction (with five-fold cross-validation) a hundred times. Credit: Milan Janosov

Janosov notes that the predictions could be improved by including other kinds of features, including "gender, being a member of a noble house, [and] sentiment analysis of the speeches." He also suggests that building a more complete dataset and comparing the narrative features of the books to the TV series might result in higher accuracy.

More information:

[cns.ceu.edu/article/2017-07-08 ... es-next-game-thrones](https://cns.ceu.edu/article/2017-07-08...es-next-game-thrones)

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