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## MINIMUM WIDTH TREES AND PRIM ALGORITHM USING ARTIFICIAL INTELLIGENCE

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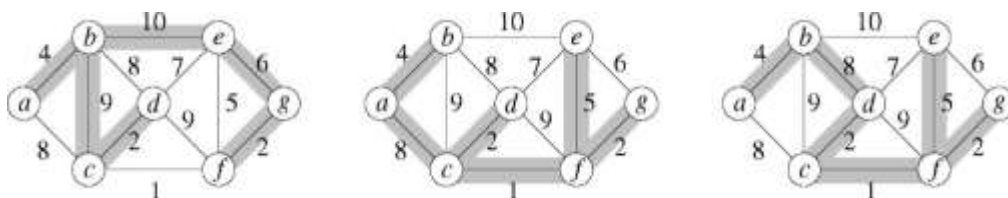
**Abstract:** *To date, many algorithms have been developed that can be calculated using the Prim algorithm. Artificial intelligence-based methods are a significant drawback. Using artificial intelligence is a very convenient method of minimizing residual trees (MST) to find the shortest path graph optimally.*

**Keywords.** *phonetics, annotation, segmentation, ai, Minimum spanning tree.*

**Minimum Spanning trees:** A common problem in communications networks and circuit design is that of connecting together a set of nodes (communication sites or circuit components) by a network of minimal total length (where length is the sum of the lengths of connecting wires. We assume that the network is undirected. To minimize the length of the connecting network, it never pays to have any cycles since we could break any cycle without destroying connectivity and decrease the total length). Since the resulting connection graph is connected, undirected, and acyclic, it is a free tree.[2]

The computational problem is called the minimum spanning tree problem (MST for short). More formally, given a connected, undirected graph  $G(V, E)$ , a spanning tree is an acyclic subset of edges  $T \subseteq E$  that connects all the vertices together. Assuming that each edge  $(u, v)$  of  $G$  has a numeric weight or cost,  $w_{u,v}$ , (may be zero or negative we define the cost of a spanning tree  $T$  to be the sum of edges in the spanning tree.

A minimum spanning tree (MST) is a spanning tree of minimum weight. Note that the minimum spanning tree may not be unique, but it is true that if all the edge weights are distinct, then the MST will be distinct (this is a rather subtle fact, which we will not prove . The figure below shows three spanning trees for the same graph, where the shaded rectangles indicate the edges in the spanning tree. The one on the left is not a minimum spanning tree, and the other two are an interesting observation is that not only do the edges sum to the same value, but in fact the same set of edge weights appear in the two MST's.[4]



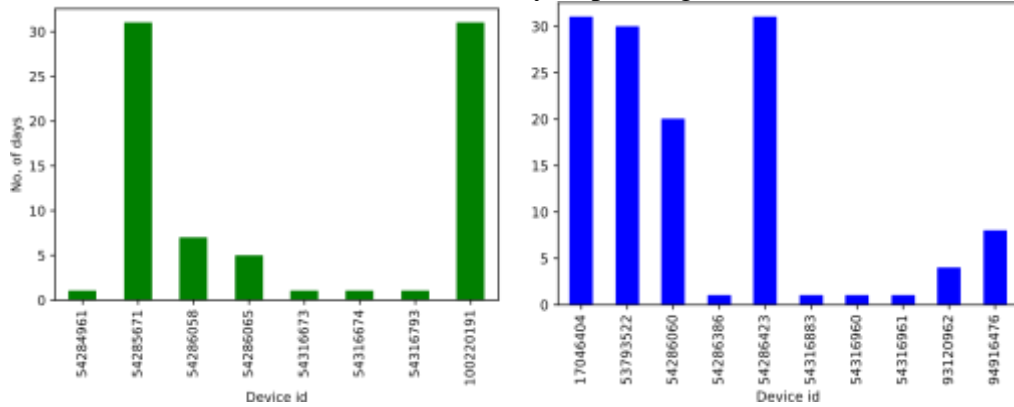
Cost = 33

Cost = 22

Cost = 22

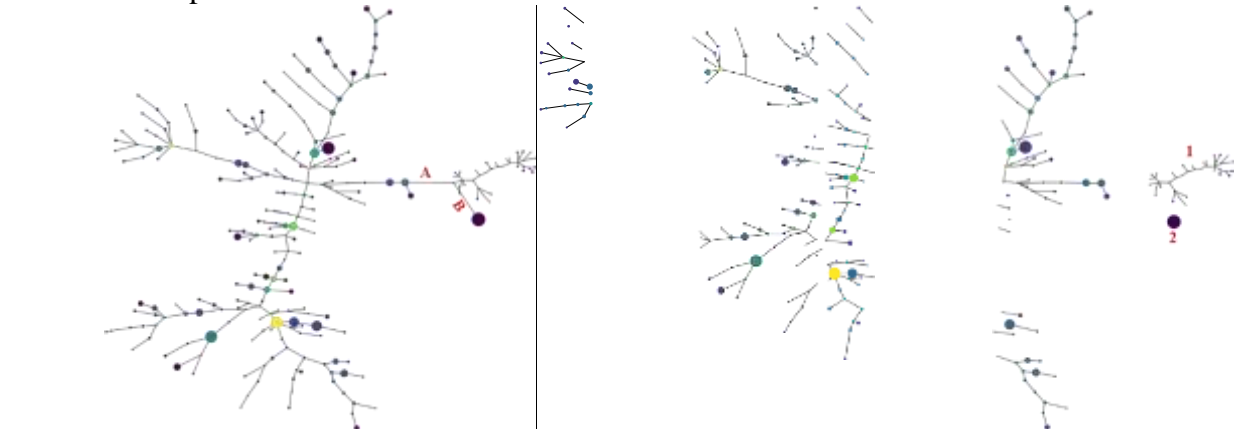
Figure 13: Spanning trees (the middle and right are minimum spanning trees).

Steiner Minimum trees: Minimum spanning trees are actually mentioned in the U.S. legal code. The reason is that AT&T was a government supported monopoly at one time, and was responsible for handling all telephone connections. If a company wanted to connect a collection of installations by an private internal phone system, AT&T was required (by law) to connect them in the minimum cost manner, which is clearly a spanning tree or is it?



(a) In dataset 1, 8 devices are identified with issues.(b) In dataset 2, 10 devices are identified with issues.

By removing the longest edge(s) of the MST, the tree will be transformed to a forest. The small sub-tree(s) with few number of clusters (nodes) and/or with smaller sized clusters can be identified as outliers.[5] The initial assumption is: the sub-trees with fewer nodes and smaller size contain patterns that happen rarely. Therefore, the clusters in these sub-trees are small, far and different from the clusters in the bigger sub-trees. The process of removing the longest edge(s) of the MST can also be performed by considering a user-specified threshold. The detected clusters of outliers can supply domain experts with a better understanding of the system behavior and facilitate them in the further analysis by mapping the detected patterns to the corresponding sequences. The proposed approach has been evaluated on smart meter data and video session data. The results of the evaluation on video session data has been discussed with the domain experts.



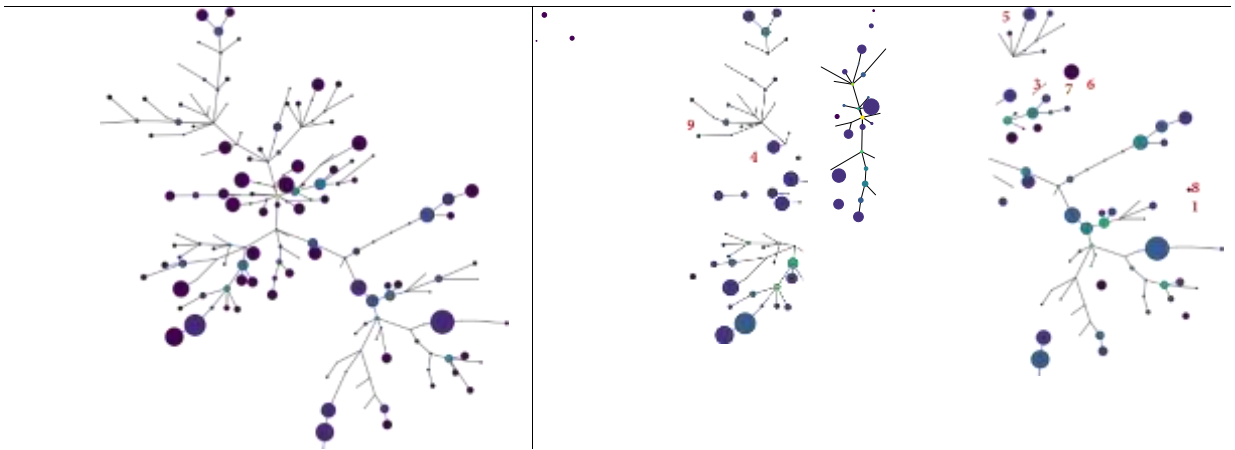


Fig. 1: (Top-left) The constructed MST before removing the longest edges on smart meter sampled dataset 1. Edges A and B represent the longest edges of the tree. (Top-right) The transformation of the constructed MST into a forest with 3 sub-trees after the longest edges are removed. The sub-trees 1 and 2 are considered as outliers based on their size.[6] (Bottom-left) The constructed MST before removing the longest edges on video session dataset. (Bottom-right) The transformation of the constructed MST into a forest with 22 sub-trees after the longest edges are removed. The sub-trees are ranked from smallest to largest based on their size. The top 10 smallest sub-trees are considered as outliers. Note. The size of a node represents the number of smart meters or video sessions that are matched with it. The color of a node shows the degree of the node and is used only for the visualization purposes. The distance between edges range between  $[0,1]$ .

### Conclusion

In this study, we have presented an outlier detection for sequence datasets. Our approach combines sequential pattern mining, clustering, and minimum spanning tree to identify outliers. We have shown that the proposed approach can facilitate the domain experts in identification of outliers. Building the minimum spanning tree on top the clustering solution can lead to identifying clusters of outliers. This can reduce the time complexity of the proposed approach. Moreover, in this study we have looked into collective outliers, sequences of events that based on their occurrence together assumed to be anomalous, which may help to find the outlying properties of the detected outliers.

The proposed approach has been applied on two sequence datasets, smart meter data and video session data. Both datasets contain sequences of event types that either shows the operational status of a smart meter or the current action that takes place in a viewer's video session.

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## QISHLOQ XO'JALIK EKINLARINING AVTOMATLASHGAN TASNIFINI YARATISHDA YUQORI ANIQLIKDAGI KOSMIK TASVIR MATERIALLARINI QO'LLANISH TAJRIBASI.

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**Annotatsiya:** *Tabiiy resurs salohiyati, er sifati va boshqalar to'g'risidagi ma'lumotlar bilan boshqaruv organlarini axborot bilan ta'minlash muammosini hal qilish eng zamonaviy axborot texnologiyalari va sun'iy yo'ldosh tasviri materiallarini jalb qilishni talab qiladi. Qaror qabul qilish jarayonida foydalaniladigan ma'lumotlarning eng muhim sifatlari ularning dolzarbligi, to'liqligi va obektivligidir. Masofadan zondlash ma'lumotlari (RSD) bu barcha afzalliklarga ega ekanligi ushbu maqolada yoritilgan.*

**Tayanch so'zlar:** *GAT, yer toyifasi, modellash, ekinlarni tuzilishi, ishlov beriladigan maydonlar, axborot texnologiyalari, sun'iy yo'ldosh tasviri.*

Masofadan zondlash ma'lumotlari (RSD) bu barcha afzalliklarga ega. RSD o'z o'lchamlari va qamrovi doirasidagi hudud haqidagi barcha ma'lumotlarni o'z ichiga oladi, qamrov bo'ylab doimiy ma'lumot maydonini va har bir obektning barcha individual xususiyatlarini o'z ichiga oladi. Masofaviy zondlash eng dolzarb ma'lumotlarni taqdim etadi, bu ayniqsa optimal yechimni ishlab chiqish uchun vaziyatni tahlil qilish uchun muhimdir. Bu ma'lumotlar zamonaviy topografik, kadastr va tematik xaritalarni yaratish uchun asos bo'lib xizmat qiladi va aslida barcha zamonaviy kartografik ma'lumotlarning asosiy manbai hisoblanadi. So'nggi yillarda turli iqtisodiy muammolarni hal qilish uchun masofaviy zondlash materiallaridan foydalanish sezilarli darajada oshdi. Zamonaviy axborot maxsulotlarining turlaridan biri bu sun'iy yo'ldoshdan olingan tasvir materiallari bo'lib, ular turli sohalarda, masalan, qishloq xo'jaligi, ekologiya, foydali qazilmalarni qidirish, mudofaa va boshqalarda muvaffaqiyatli qo'llanilishi mumkin[1-6]. Shu bilan birga, sun'iy yo'ldoshdan suratga olish materiallaridan foydalanish ulushi aerofotosurat materiallaridan foydalanishga nisbatan tezroq o'sib bormoqda.