A Detailed Study on Skolem Mean Labeling for Disjoint Union of Six Star Graphs

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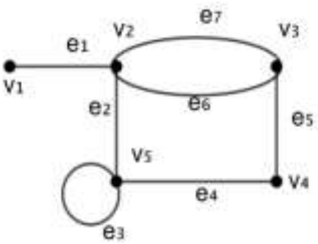
Definition: Graph

A graph G = (V(G), E(G)), consists of two finite sets, V(G), the vertex set of the graph, often denoted by just V, which is non-empty sets of elements called vertices, E(G), the edges set of the graph, often denoted by just E, which is possibly an empty set of element called edges.



A graph G with five vertices and seven edges.

$V(G) = \{V_1, V_2, V_3, V_4, V_5,\}$

$E(G) = \{e_1, e_2, e_3, e_4, e_5, e_6, e_{7,}\}$

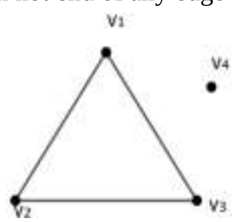
Definition: Empty Graph

An empty graph is graph with no edges.

In the graph empty graph with two vertices.

Definition: Isolated

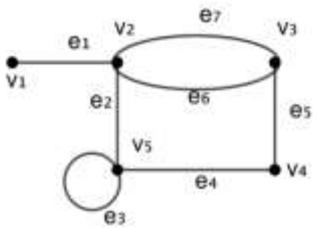
A vertex of G which not end of any edge is called isolated.



A graph G with isolated vertex v_4

Definition: Parallel

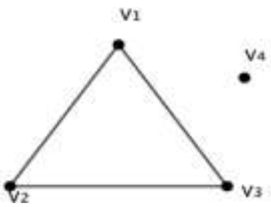
Let G be a graph. If two edges of g have the same end vertices, then these edges are called parallel.



The edges e_6 and e_7 of the graph of are parallel.

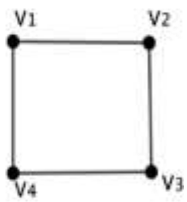
Definition: Adjacent

Two vertices which are joined by an edge are said to be adjacent (or) neighbours. In the graph v_2 and v_3 are adjacent but v_1 and v_4 are not adjacent.



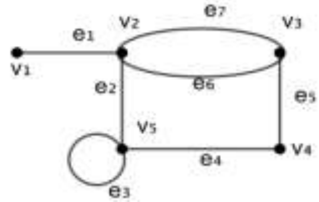
Definition: Simple Graph

A graph is called simple if it has no loops and no parallel edges.



Definition: Multigraph

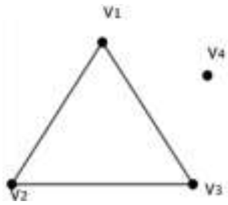
A graph which is not simple is called a multigraph.



In the graph, G is a multigraph.

Definition: Neighbourhood Set

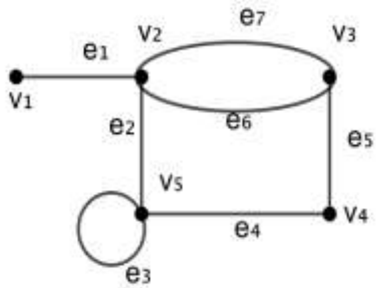
The set of all neighbours of a fixed v of G is called the neighbourhood set of v and is denoted by N(v).



In the graph of the neighbourhood set $N(v_1)$ of v_1 is $\{v_2, v_3\}$.

Definition: Loop

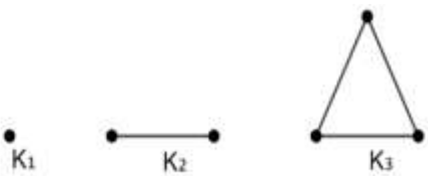
It is possible to have a vertex u joined to by an edge, such an edge is called as a loop.



In the graph the vertex v_5 has the loop.

Definition: Complete Graph

A complete graph is a simple graph in which each pair of distinct vertices is joined by an edge. It is denoted by K_n.

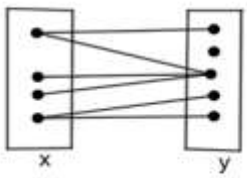


In the complete graph with one, two, and three vertices.

Definition: Bipartite Graph

A graph G is trivial if its vertex set is singleton and it contains no edges.

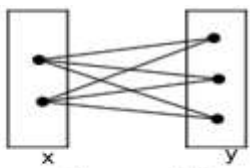
A graph is bipartite if its vertex set can be partitioned into two nonempty subset X and Y such that each edge of G has one end in X and the other in Y. the pair (X, Y) is called a bipartition of the bipartite graph. The bipartite graph G with bipartition (X, Y) is denoted by G(X ,Y).



A bipartite graph

Definition: Complete Bipartite Graph

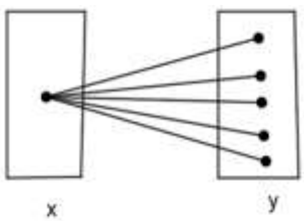
A simple bipartite $G(X,Y)$ is complete if each vertex of X is adjacent to all the other vertices of Y. If $G(X,Y)$ is complete with |X| = p and |Y| = q, then $G(X,Y)$ is denoted by $K_{p,q}$.



The graph $K_{2,3}$

Definition: Star Graph

A complete bipartite graph of the form $K_{1, q}$ is called a star.

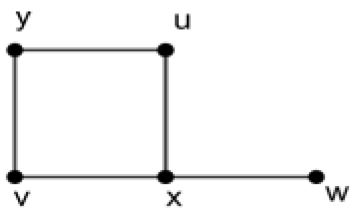


The graph $K_{2,3}$

Definition: Vertex Independent Sets

A subset S of the vertex set V of a graph G is called independent if no two vertices of S are adjacent in G. S $\subseteq$ V is a maximum independent set of G if G has no independent set S' with |S'|>|S|. A maximum independent set that is not is a proper subset of another independent set of G.

For example, in the graph of figure $\{u,v,w\}$ is a maximum independent set and $\{x,y\}$ is maximal of that is not maximum.

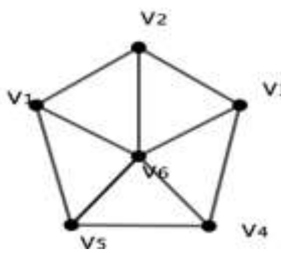


{u, v, w} → maximum independent set.
{x, y} → maximum independent set.

Definition: Covering

A subset k of V is called a covering of G if every edge of G is incident with at least one vertex of k. A covering k is minimum if there is no covering k' of G such that |k'|<|k| it is minimal if there is no covering k_1 of G such that k_1 is a proper subset of k.

Example



$\{v_6\}$ is the minimum covering of the figure.

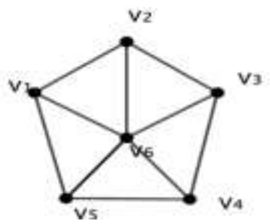
In the graph w_5 of figure $\{v_1, v_2, v_3, v_4, v_5\}$ is a covering of w_5 and$\{v_1, v_3, v_4, v_6,\}$ is a minimal covering. Also the set $\{x,y\}$ is a minimum covering of the graph of figure.

Definition: Edge Independent Set

1. A subset M of the edge set E of a loopless graph G is called independent if no two edges of M are adjacent in G.
2. A matching in G is a set of independent edge.
3. An edge covering of G is a subset L of E such that every vertex of G is incident to some edge of L. Hence an edge covering of G exists if δ >0.
4. A matching M of G is maximum if G has no matching M' with │M'│>│M│. M is maximum strictly containing M. ά(G) is the cardinality of a maximum matching and β'(G) is the size of a minimum edge covering of G.
5. A set of vertices of G is said to be saturated by a matching M of G or M-saturated if every vertex of S is incident to some edge of M.A vertex v of G is M-saturated if {v} is M-saturated. V isM-unsaturated if it is not M- saturated.

Definition: Augmenting Path

An M-augmenting path in G is a path in which the edges alternate between E/M and M and its end vertices are M-saturated.An M-alternating path in G is a path whose edges alternate between E/M and M.



Example

In the graph G of the above figure, M_1 = $\{v_1v_2, v_3v_4, v_5v_6\}$ and,

$M_2 = \{v_1v_2, v_3v_6, v_4v_5\}$ and,

$M_3 = \{v_3v_4, v_5v_6\}$ are matching of G. The path $v_2v_3v_4v_6v_5v_1$ is an M_3- augmenting path in G.

Definition: Matching

A matching of a graph G is a set of independent edges of G.

If $e = uv$ is an edges of a matching M of G, the end vertices u and v of e are said to be matched by M.

If M_1 and M_2 are matching of G, the edge subgraph defined by $M_1 \Delta M_2$, the symmetric difference of M_1 and M_2 is a subgraph H of G whose components are paths or even cycles of G in which the edges alternative between M_1 and M_2

A matching of a graph G is a set of independent edges of G. If $e = uv$ is an edge of a matching M of G, the end vertices u and v are said to be matched by M.

Definition: Perfect Matching

A matching M is called a perfect matching if every point of G is M-saturated M is called a maximum matching if there is no matching M' in G such │M'│≤│M│

Example

Consider the graph G_1 gives in figure $M_1 = \{v_1v_2, v_6v_3, v_5v_4\}$ is a perfect matching in G_1. Also $M_2 = \{v_1v_3, v_6v_5\}$ is matching in G_1. However M_2 is not a perfect matching since the vertices v_2 and v_4 are not M_2 - saturated.

For the graph G_2 given infigure $M = \{v_1v_2, v_8v_4\}$ is a maximum matching but it is not a perfect matching.

For the G_1 given in a figure $P_1 = \{v_6, v_5, v_4, v_3\}$ is an M_1– alternating path also $P_2 = \{v_2, v_1, v_3, v_6, v_5, v_4\}$ is an M_2 - alternating path.

Definition: Perfect Matching

A factor a graph G is spanning subgraph of G. A k- factor of G is a factor of G this is k- regular. Thus 1- factor of G is a matching that Saturates all the vertices of G and 1- factor of G is perfect matching if G.

For example, in the wheel (fig 1) $M = \{v_1v_2, v_4v_6\}$ is a maximal matching;

$\{v_1v_5, v_2v_3, v_4v_6\}$ is a maximum matching and a minimum edge covering the vertices v_1, v_2, v_4 and v_6 are M-saturated whereas v_3 and v_5 are M-unsaturated.

Computer Network Topology, Illustrated

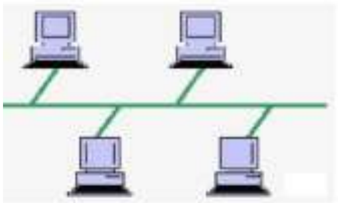
Types of Network Topology

Computer network topology refers to the physical communication schemes used by connected devices on a network. The basic computer network topology types are:

Bus
Ring
Star
Mesh
Tree
Wireless

Networks that are more complex can be built as hybrids using two or more of these basic topologies.

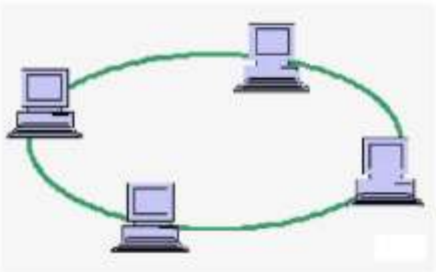
Bus Network Topology



Bus networks share a common connection that extends to all devices. This network topology is used in small networks, and it is simple to understand. Every computer and network device connects to the same cable, so if the cable fails, the whole network is down, but the cost of setting up the network is reasonable.

This type of network is cost effective. However, the connecting cable has a limited length, and the network is slower than a ring network.

Ring Network Topology



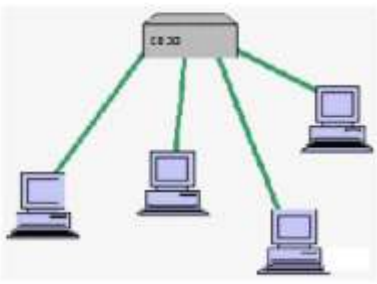
Each device in a ring network is attached to two other devices, and the last device connects to the first to form a circular network. Each message travels through the ring in one direction – clockwise or counter clockwise – through the shared link. Ring topology that involves a large number of connected devices requires repeaters. If the connection cable or one device fails in a ring network fails.

Although ring network are faster than bus network they are more difficult to troubleshoot.

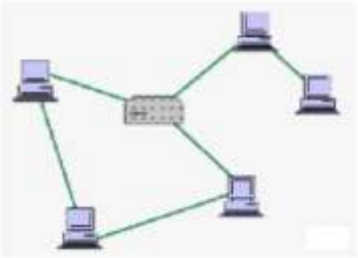
Star Network Topology

A star topology typically uses a network hub or switch and is common in home networks. Every device has its own connection to the hub. The performance of a star network depends on the hub. If the hub fails, the network is down for all connected devices. The performance of the attached devices is usually high because there are usually fewer devices connected in star topology that in other types of networks.

A star network is easy to set up and easy to troubleshoot. The cost of setup is higher than for bus and ring network topology, but if one attached device fails, the other connected devices are unaffected.



Mesh Network Topology



Mesh network topology provides redundant communication paths between some or all devices in a partial or full mesh. In full mesh topology, every device. In a partial mesh topology, some of the connected to all the others, but some of the device only connect to a few other devices.

Mesh topology is robust and troubleshooting is relatively easy. However, installation and configuration are more complicated then with the star, ring and bus topologies.

Tree Network Topology

Tree topology integrates the star and bus topologies in a hybrid approach to improve network scalability. The network is setup as hierarchy, usually with at least three levels. The devices on the bottom level all connected to one of the devices on the level above it. Eventually, all devices lead to the main hub that controls the network.

This type of network works well in companies that have various grouped workstations. The system is easy to manage and troubleshoot. However, it is relatively costly to set up. If the central hub fails, then the network fails.

Wireless Network Topology

Wireless networking is the new kid on the block. In general, wireless networks are slower than wired networks, but that is changing quickly. With the proliferation of laptops and mobile devices, the need for networks to accommodate wireless remote access has increased vastly.

It has become common for wired network to include a hardware access point that is available to all the wireless devices that need access to the network. With this expansion of the capabilities comes potential security issues that must be addressed.

Fingerprint Recognition Using Graph Representation

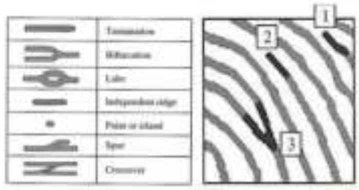
The three characteristics of FINGER PRINTS are:

1. There are no similar fingerprints in the world.
2. Fingerprints are unchangeable.
3. Fingerprints are one of the unique features for identification systems.

Fingerprint Types

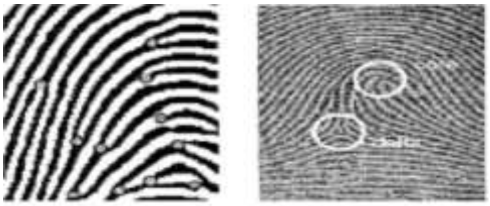
The lines that flow in various patterns across fingerprints are called Ridges and the space between ridges are valleys.

Content



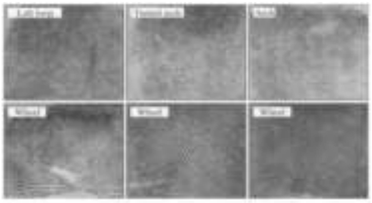
Types of patterns in fingerprint. 1 and 2 are terminations 3 is bifurcation.

Minute, Core and Delta

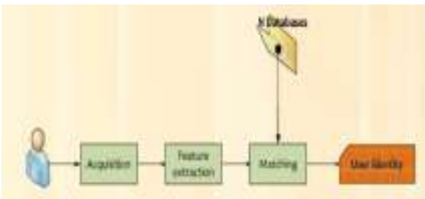


Minute - The places at which the Core - The places where the ridges form a half Ridges intersects or ends. Circle. Delta-The places where the ridges form a triangle.

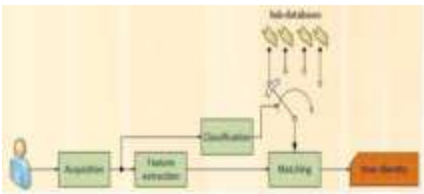
Different Classification



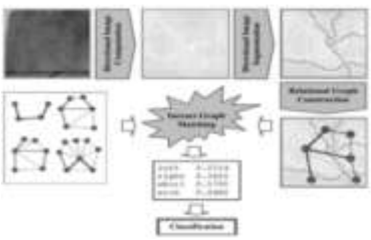
Old Method



New Method

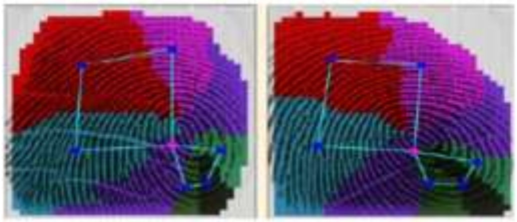


Process Flow

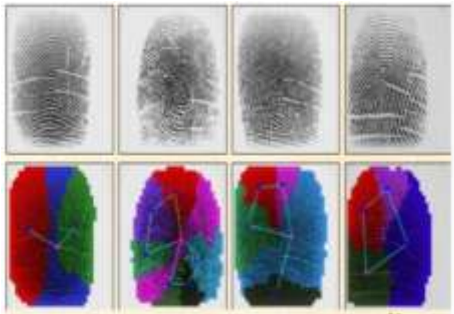


Fingerprint Capture Devices

Segmentation of Directional Image



Arch whorl



Right loop Left loop

Segmentation

Construction of Related Weight Graph

Graph can be shown by G index including four parameters of $G = (V, E, \mu, U)$

Where

V is number of nodes.

E is number of edges.

μ is weight of nodes.

U is weight of edges.

Some information can be used in construction the graph related to a finger print like.

- Centre of gravity of regions.
- The direction related to the elements of the various regions.
- The area of all the regions.
- The distance between centers of gravity.
- The perimeter of regions.

Weightage to Nodes and Edges

W_n = Area$\left(R_j\right)$

Where,

$\rightarrow i = 1,2,3,....n$

$\rightarrow W_n$ is the weight of nodes.

$\rightarrow R_j$ is the specified region in block directional image.

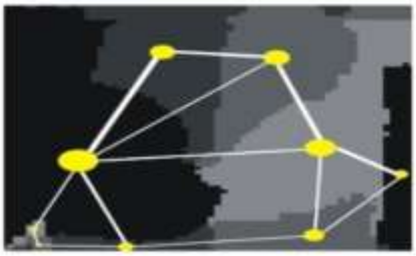
W_n = (Adj - p) × (Node - p) × (Diff - v)

Where

→ Adj-p is the boundary of two adjacent regions linking with an edge.

→node-d is the distance difference between nodes that links by an edge

→ Diff-v is the phase difference or direction difference between two regions of block directional image.



The nodes are placed in the center of gravity of each region. The nodes size varies according to the weight. The edges are shown by the lines and the thickness is proportional to the weight.

Construction Super Graph

We combine the properties of the graph and model of the Super Graph to form,

- A node for region with similar directions.
- Its co-ordinates are the center of gravity related to those regions of the graph.

Weightage to Snodes and Sedges

$W_{sn} = \sum_{i=1}^{n} Area\left(R_j\right)$

Where,

Area R_i is the area of all regions with similar directions.

R_i includes regions with similar directions.

W_{se} = dis(sn) + $\sum_{i=1}^{n} Adj - p\ (R^{i,\ R_J}\ )$

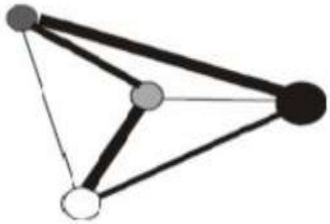
Where

W_{se} is the weight of edges in super graph.

dis(sn) is the distance between nodes of a super graph.

Adj-p is the sum of the adjacent perimeter between two regions.

Super Graph



- The obtained block directional image have four directions, so we have four nodes.
- All the nodes are connected with the other three edges.
- If the number of nodes are high, its take much time to find a match.

Retrieving the Fingerprints

- Fingerprints are classified according to their structure.
- A sample from each structure is taken for comparison.

Cost function = $(\sum_i (W_{i.node}$-"$W_{i.node}))(\sum_j (W_{j.edge}$-"$W_{j.edge}))$

where

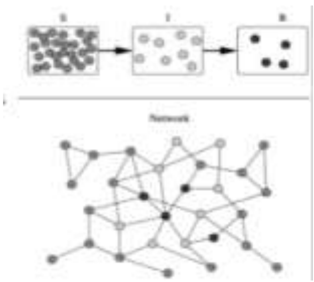
$W_{i.node}$ and $W_{j.edge}$ are the node weight and edge weight of the Super graph.

“$W_{i.node}$ and “$W_{j.edge}$are the node weight and edge weight of the model Super graph.

- Different classification give different cost value. Among that the lowest cost value function is taken and the comparison of the fingerprint proceeds in that class.
- By this method high accuracy is achieved in short comparison time.
- Previously FBI used 3 major classifications for matching the fingerprints and they had many sub-classifications.
- But now they use around 10 major classifications and manysub-classifications which gives them a fast result.

Epidemology

- Networks model used to represent the spread of infectious diseases and design prevention and response strategies.
- Vertices represent individuals, and edges their possible contacts. It is useful to calculate how a particular individual is connected to others.



- Knowing the shortest path lengths to other individuals can be relevant indicator of the potential of a particular individual to infect others.

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