Dist: 5

Dist: 6

Dist: 3

Object: Front Wheel

Color: Silver

Object: Back Wheel

Color: Silver

Object: Window

Color: White

1. **Message Passing**

\q{Let $A$ be a set of attributes. An \emph{attributed graph} $(V,E,\sigma)$ consists of a set of vertices $V$, a set of edges $E\subseteq V\times V$, and a function $\sigma$: $V \mapsto A$ which assigns each vertex $v\in V$ with a set of attribute values in $A$. (continue to define the notion of subgraph explicitly ... for example: A graph $G=(V,E,\sigma)$ is a \emph{subgraph} of $G\_1=(V\_1,E\_1,\sigma\_1)$ if $V\subseteq V\_1$, $E\subseteq E\_1$, for each edge $(v,v')\in E\_1$ with $\{v,v'\}\subseteq V$, there is an edge $(v,v')\in E$ and $\sigma(v)=\sigma'(v)$ for each $v\in V$) (you need to define the similarity in a general sense as well, e.g., Given two graphs $G$ and $G'$, a \emph{similarity function} (denoted as $sim$) defines a similarity score between $G$ and $G'$ that should satisfy certain properties such as identity, symmetry, and triangle inequality... )}

\q{Let $G\_1 = (V\_1,E\_1,\sigma\_1)$ and $G\_2 = (V\_2,E\_2,\sigma\_2)$ be two attributed graphs. Then the problem of \emph{attributed subgraph matching} is to, given a subgraph $G\subseteq G\_1$ where $G=(V,E,\sigma)$, find a subgraph $G'\subseteq G\_2$ where $G'=(V',E',\sigma')$ such that $|V|=|V'|$ and $sim(G,G')\geq sim(G,G^{''})$ for any other subgraph $G^{''}\subseteq G\_2$ with $G^{''}=(V^{''}, E^{''},\sigma^{''})$ and $|V^{''}|=|V|$.}

Denote $|V|=N$ and $|V'|=N'$. For any connected subgraph $g$ of $G$ with $|g|= n$ our goal is to find the top-k distinct connected subgraphs $\{g\_i' \ | \ i\in [1, k], |g\_i'|=n\}$ of $G'$ such that any other subgraph $g\_k'$ of $G'$ satisifes $similarity(g,g\_i')\le similarity(g,g\_k')$. Since we are matching subgraphs, it is natural to have pairs of subgraphs as the training data. This modification from the original attributed subgraph matching problem allows us to intuitively learn from these matching pairs.\fix{modify it to make it more formal} We denote the training pairs as $\{(g\_k,g\_k')\}$ with $|g\_k| = n$ and let the dimension of the feature encoding of each node to be $m$, therefore, each graph can be represented as a $n\*m$ matrix. \q{\sout{In this work, we omit the edge attributes. It could be a potential future research orientation.}(if you don't consider it, then just don't define it on graphs at the beginning)}