- graph vertex node member methods:

in tais context
means whither one vertus is closer than some other vertus - our overridden sumantis deperul an Evelickan distance between nodes
- What chout gragh olfect?
template < typename $T>$ class Graph; I/forward declavation
template <dypenane $T>$
class Graph?
privat.?
Vector $\left\langle V_{\text {ertax }}\langle T\rangle *\right\rangle$ VerteroMap; II lit of uodes
publas:
Graph (): vertasMap () $\}$;
voiel addVertes (it $i, T p$, int $n$ );
voich addedge (it $i$, int $j$ );
voil resige $($ int $n) \quad\{$ ventasomap.resize $(n, \phi) ;\}$
3 Gaot myatsh; my griph. arize ( 10,000 );
in graph. (pp)
template <-Mpenane $T$ ) void $G \operatorname{raph}\langle T\rangle: i$ add vertex (int $i$, T $\rho$, int $n$ ) \{
hour many adjacent vertices we expert at tho vertex Cove we 're all的

$$
\}
$$

$$
\begin{aligned}
& \text { Vertex }\langle T\rangle \quad * V j \\
& \text { if }((V=\operatorname{ventax} \operatorname{Map}[i])==\operatorname{NUCL})\{ \\
& V=\text { new } \operatorname{Vertax}\langle T\rangle(i, p, n) \text {; } \\
& \text { verthesomap }[i]=V_{j} \\
& \text { \} } \\
& \text { must allaats } \\
& \text { array of adjacent } \\
& \text { venters }
\end{aligned}
$$

-logical" strutive y gropsh:


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template <typenane $T$ >
void Graph $\langle T\rangle: 1$ add Edge (i nt $i$, it $j$ )
\}

$$
\begin{array}{r}
\text { vertex Map } i] \rightarrow \text { adj } j \quad[\text { vertex Map }[i] \rightarrow \text { edges } H]= \\
\text { ventexpMap }[j] ;
\end{array}
$$


(3)
at bottom of graph.cpp:
II specializatons
tenplats struet Vectex $\langle$ Point $\infty>$;
terplate ortrem $Q$ operator $\ll$ (osstrem QS,
tenplate class Graph<lount to >;
tesplate atruct Veatas $<$ Tangent Plave d $>$;
teuplate osficama sperator $\ll$ Cosframe $Q$ S
Const Vantess <Tangertfleneds>0
tuplate clas Gruph < Tayent Plave $t$ 〉; (hs)i

- We have the making of a graph - now what?
- ir phase 2, we need to correct our tangent Place normals by aligning them
from phot 1:


Nav, conneat them, salegn nornals to paint in save div.
 if connected normals point in oplouste dis to neglibis," "flip" normals by neatly then


- Connections between To's establisised by creation of minimum spanning tree (MST) ( $\beta .372$ )
- MST: MST of vndivatel graph $C$ iv a Gree (no cycles) formal gram graph edges that $\frac{\text { connect all the vertices of } G \text { at } \frac{\text { (avert } \cos t}{\text { (spans all resties) }} \text { (mining) }}{\text { (s) }}$
in our case, edge weight $=$ Evclideam distance between nodes (Jp centers)

$$
\begin{aligned}
& \underset{T_{p i}}{\stackrel{\rightharpoonup}{c o s t}=\left\|T_{p i}-T_{p i}\right\|} \\
& =\sqrt{\left(T p_{i} \cdot x-T p_{j} x\right)^{2}+7} \begin{array}{l}
\left(T p_{i} \cdot y-T p_{j} \cdot y\right)^{2}+ \\
\left(T p_{i} \cdot z-T p_{j} \cdot z\right)^{2}
\end{array}
\end{aligned}
$$

- An MST of 6 exaits only if 6 is connenteal
- need move in go: whins vertices are connentiad?
- Acorling to tope (our research paper),
a simple gray to get the MST is to consfirct the EMST: Evclidean Minsuenspanig The
The simplest algorithm to find an EMST, given $n$ points, is to actually construct the complete graph on $n$ vertices, which has $n(n-1) / 2$ edges, compute each edge weight by finding the
distance between each pair of points, and then run a standard minimum spanning tree
- given $n$ points in $\mathbb{R}^{3}$ (3-spare), constrict the couplets graph on $n$ version $(n(n-1) / 2$ edges) dor $i=0 ; i<$ taygubplues, sjec $) ; \delta+\infty)$
arch coldrectess ( $i$, tapped Puss $[i), n-1$ )
$\operatorname{for}(i=0 ; i<$ tagotlous. Sue (); it)
for $(i=0 ; j<$ tagus Place. $\operatorname{dg}() ; U++)$
if $(i!=j)$ sooth aldedy $(i, j)$
- Confute each edge wet as distance hotien each pair of vertices $(i, j)$ - can defer the stop to MST ald.
- pun standard MJT all. such n Prim's based en fibonaric heat binary heap

Tuesday, October 17, 2006
3:22 PM

- Prim'r alg:

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