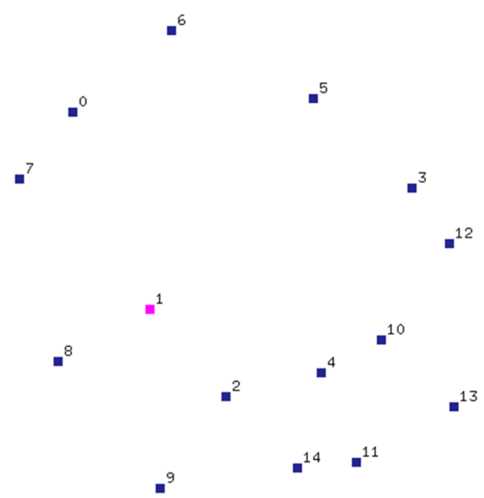
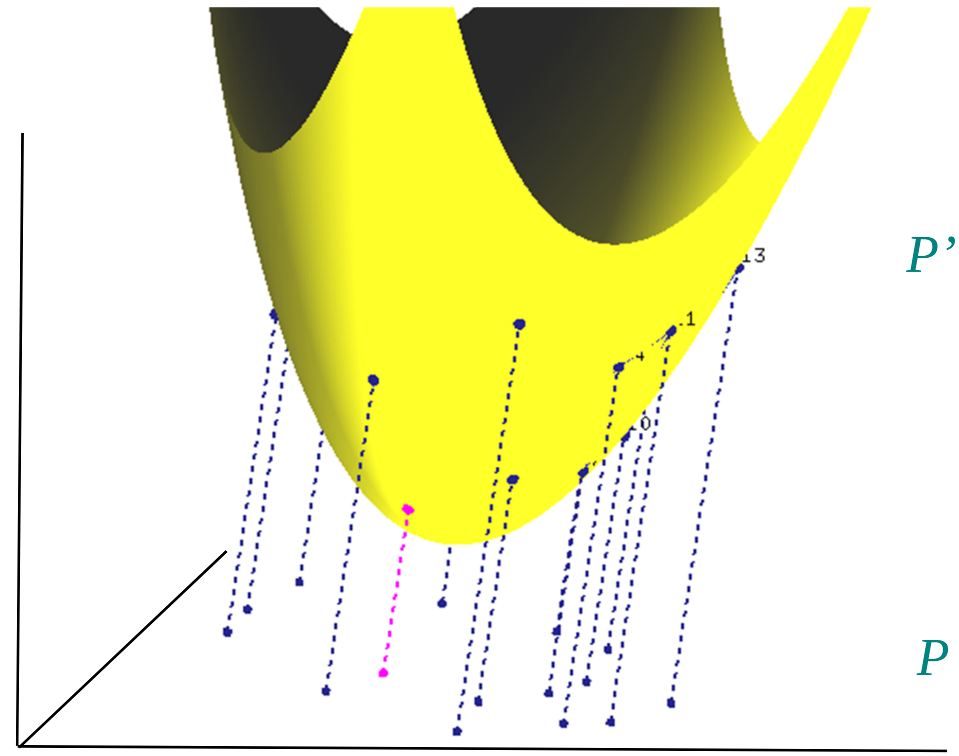
# DT and 3D CH

**Theorem:** Let $P=\{p_1,\ldots,p_n\}$ with $p_i=(a_i, b_i,0)$. Let $p'_i=(a_i, b_i, a^2_i+ b^2_i)$ be the vertical projection of each point $p_i$ onto the paraboloid $z=x^2+ y^2$. Then DT($P$) is the orthogonal projection onto the plane $z=0$ of the lower convex hull of $P'=\{p'_1,\ldots,p'_n\}$ .




Pictures generated with Hull2VD tool available at http://www.cs.mtu.edu/~shene/NSF-2/DM2-BETA

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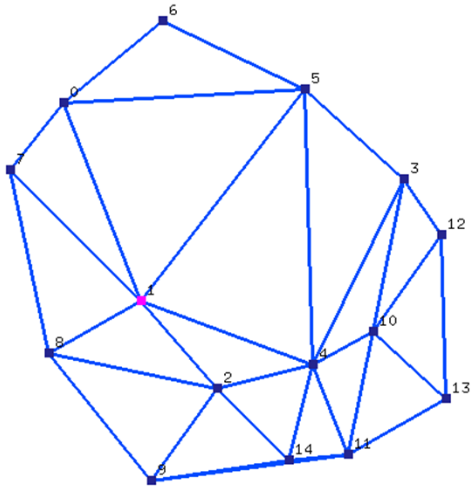


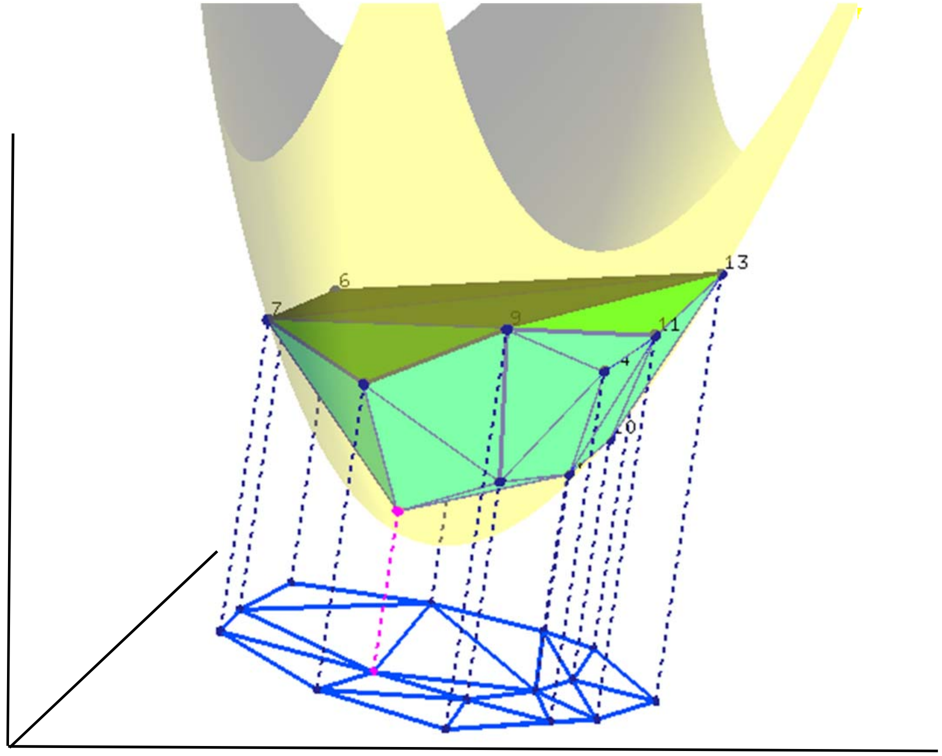


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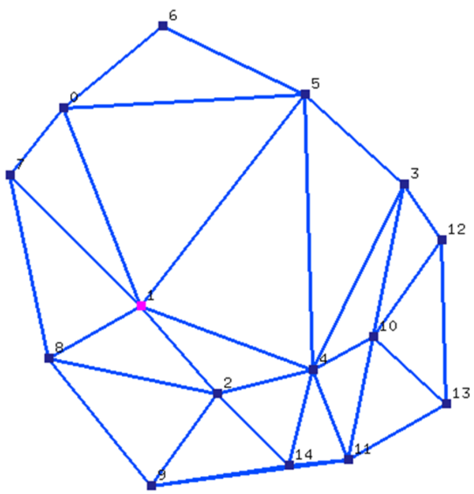

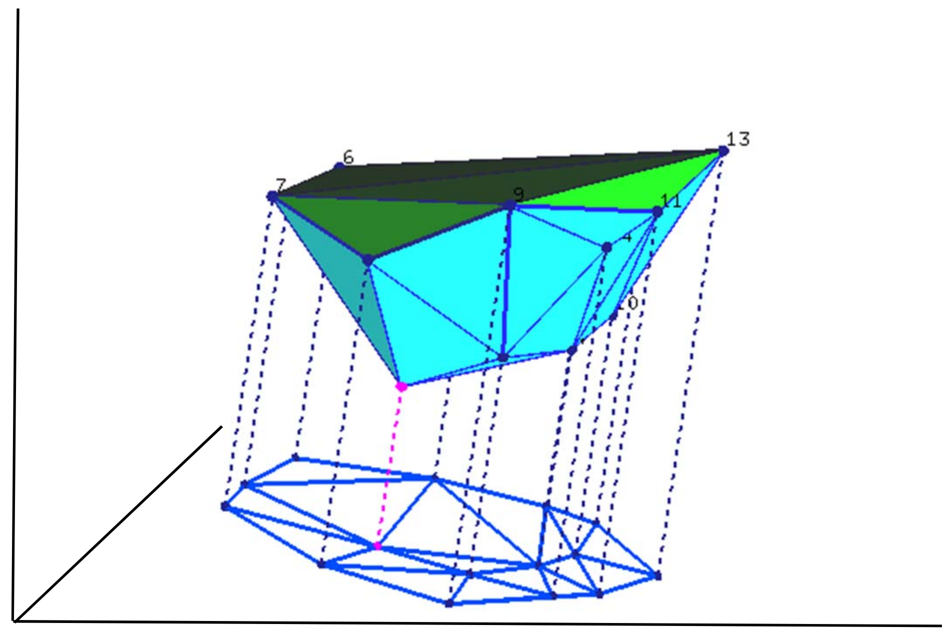

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$p'_i, p'_j, p'_k$ form a (triangular) face of LCH($P'$).

⇔

The plane through $p'_i, p'_j, p'_k$ leaves all remaining points of $P$ above it.

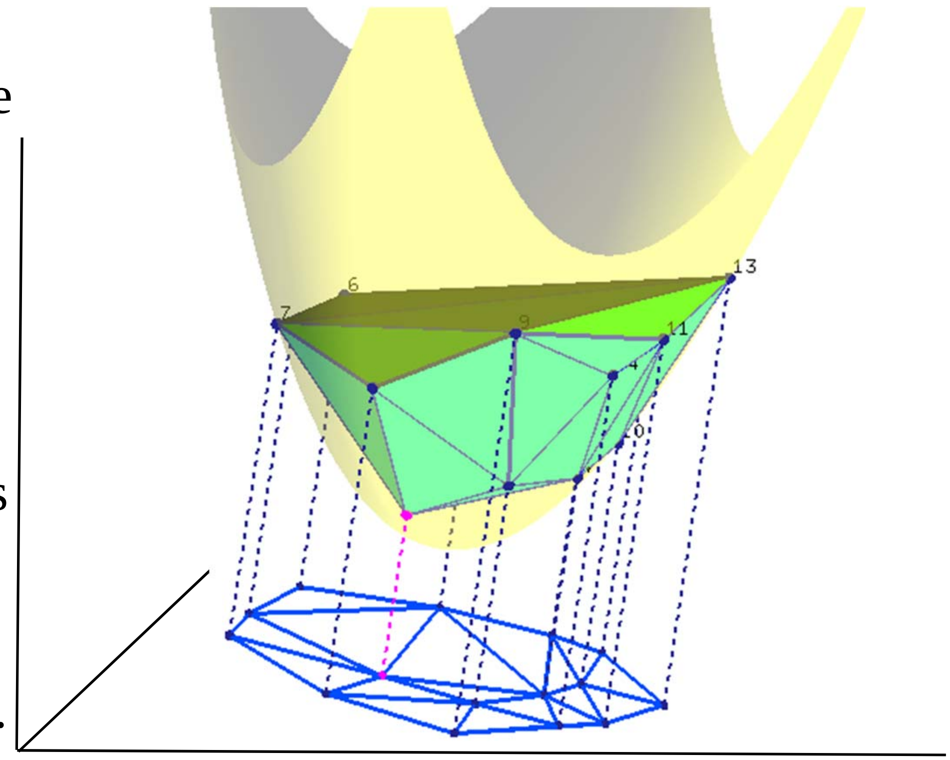
⇔

The circle through $p_i, p_j, p_k$ leaves all remaining points of $P$ in its exterior.

⇔

$p_i, p_j, p_k$ form a triangle of DT($P$).

property of unit paraboloid




Slide adapted from slides by Vera Sacristan.