Subject: Re: equally spaced points on a hypersphere?
Posted by tam on Fri, 29 Oct 2004 16:10:17 GMT
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Craig Markwardt wrote:
> Matt Feinstein <nospam@here.com> writes:
>
>> On 29 Oct 2004 07:51:58 -0700, robert.dimeo@nist.gov (Rob Dimeo)
>> wrote:
>>
>>
>>> Hi,
>>>
>>> I would like to create (n+1) equidistant points on an n-dimensional
>>> sphere. The initial information provided is the center of the sphere,
>>> the radius, and *any* point on the sphere. From that you need to find
>>> the coordinates for the remaining n points. As a simple example,
>>> three equidistant points on a 2-dimensional sphere (a circle), can be
>>> located 120 degrees apart. Any hints on how to do this in general for
>>> n-dimensions?
>
>
> This is commonly called "tesselating" the sphere, or hypersphere in
> this case.
>
>
>> Unfortunately, when you go to dimension greater than two, there are
>> constraints on the number of 'equidistant' points you can have on a
>> sphere. For example, in 3-D, there are (only) five regular polyhedra,
>> so n can only have the values 4, 6, 8, 12, and 20 for a tetrahedron,
>> octahedron, cube, icosahedron, and dodecahedron.
>
>
> So is there any requirement that the tesselation produce a regular
> polyhedron?
>
> Clearly it is possible to place *any* number of equidistant points on
> a sphere via an iterative approach. As discussed on line, start
> with random placement of points, allow the points to repel each other,
> iterate until you reach the lowest energy configure.
>
> Whether such an approach will work for Rob, I don't know.
>
> Craig
>

I'm not sure what it means to have 'equidistant' points on a sphere.

I don't think the OP wants each point to be equidistant from all other points -- I don't think that's possible for more than n+1 points in an n-dimensional space.

Craig indicates one take on the problem, but the OP may want to frame it more carefully, e.g., a different criterion might be to maximize the mininum distance between any two points. I don't know if that has the same solution. Matt points out that only in a special cases will the soution be regular, for most sets of points the 'facets' defined by points will not all regular, equal polygons.

A quick Google search came up with
http://nrich.maths.org/askedNRICH/edited/1125.html
that gives some interesting references.

Regards,
Tom McGlynn