Updates

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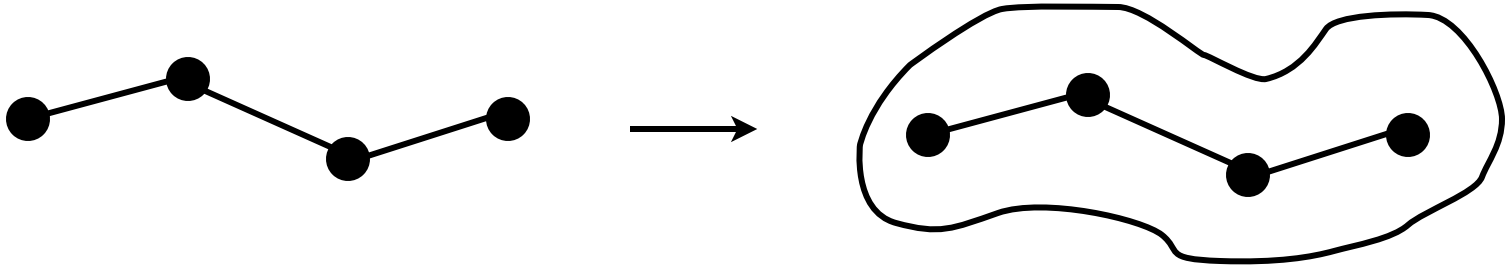
2011/03/11

Some things we did...

- Metaballs
- Hot coupling results
- Specification of factor graphs in scheme
  - Tree

Metaballs



- Task: Given a set of points, generate a blobby shape.
- Method: metaballs

Reference: JF Blinn, "A Generalization of Algebraic Surface Drawing"

Metaballs - some math...

$$F(x, y, z) = D(x, y, z) - T$$

T is the threshold. We set T = 1 as suggested by the paper.

$$D(x, y, z) = \sum_i b_i \exp(-a_i r_i^2)$$

basic form

$$T = b_i \exp(-a_i R_i^2) = \exp(-a_i R_i^2 + \ln b_i)$$

relating the radius (R) with T

$$a_i = -\frac{\ln(T/b_i)}{R_i^2}$$

$$B_i = \ln\left(\frac{T}{b_i}\right)$$

relating the blobbiness (B) with T

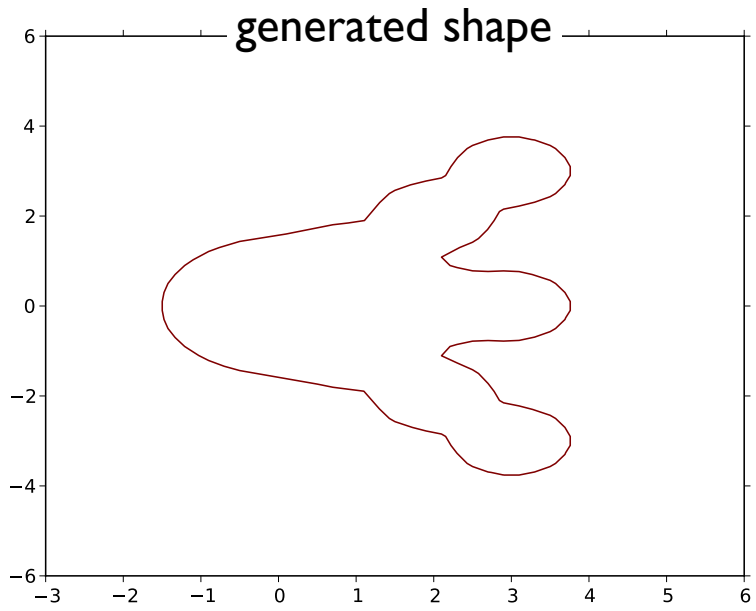
$$b_i = T \exp(-B_i)$$

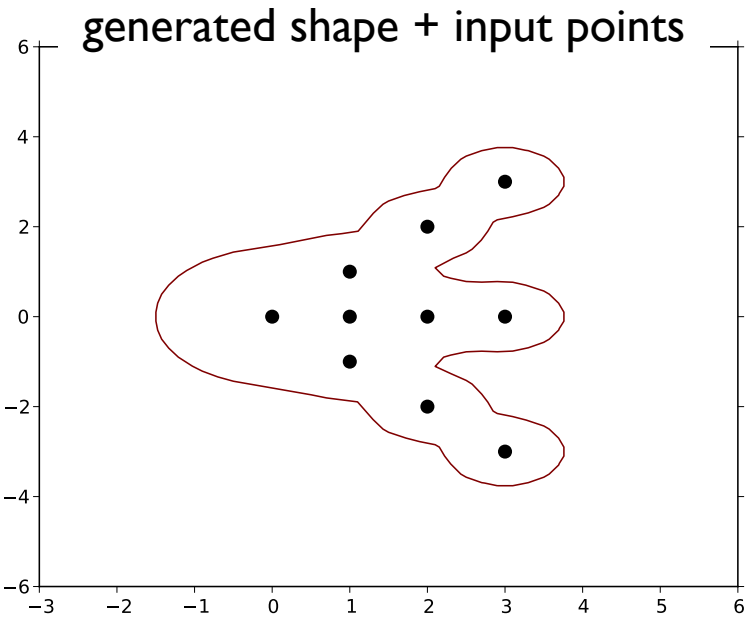
$$D_i(x, y, z) = T \exp\left(\frac{B_i}{R_i^2} r_i^2 - B_i\right)$$

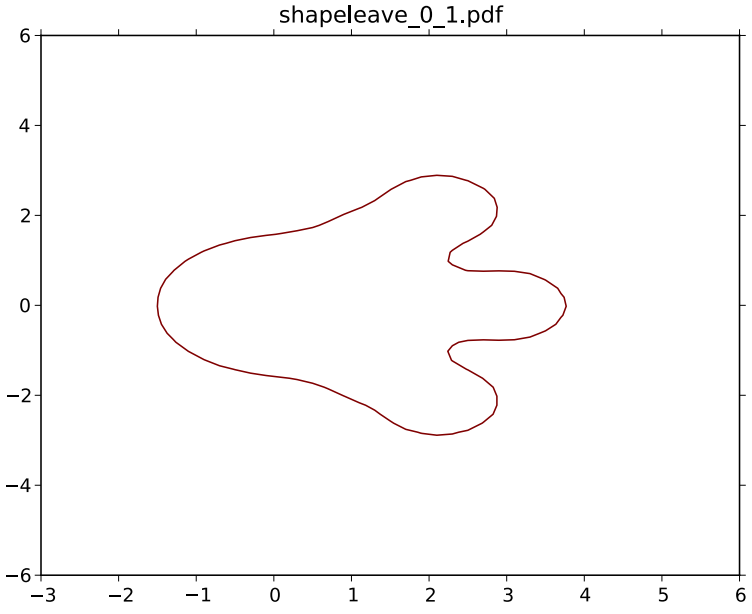
parameterized form of each term

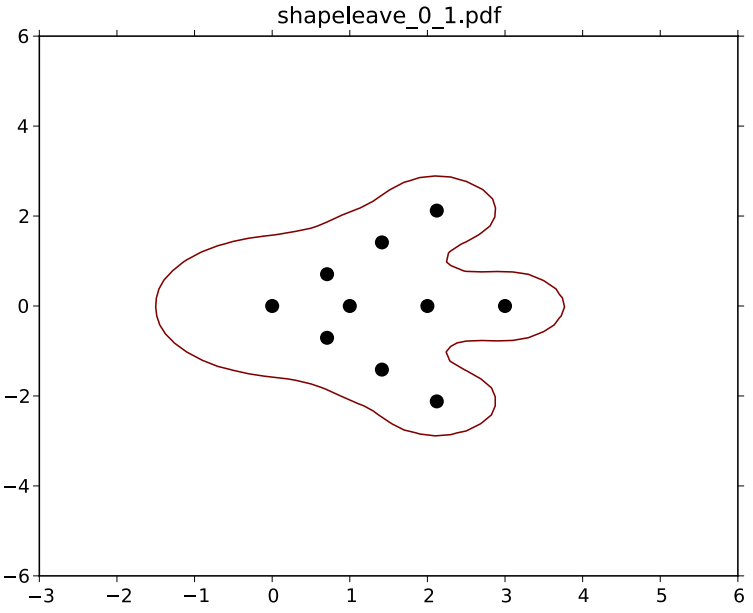
Results

We tried to make leaf-like shapes, ...but they look like feet.....









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Parameters for Metaballs

- Currently, the shape is determined by three things: points, radius, blobbiness
- It would be interesting to see how to use edge information to control the shape.
  - so that we can create rods.

Synthesize Images with Hot Coupling

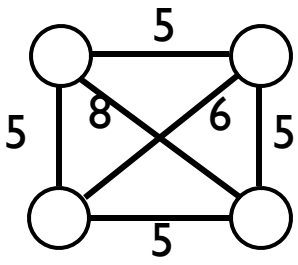
- We implemented Hot-Coupling to sample from factor graphs.
- Implementation detail
  - 50 particles
  - Predefine the order of factor introduction
  - The process of coupling an added factor is implemented as an AIS run

Synthesized

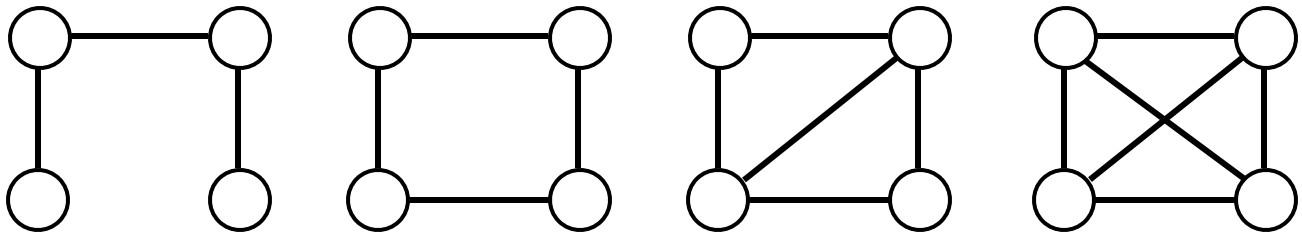
Results

The target factor graph specifies a diamond shape.

Target factor graph:

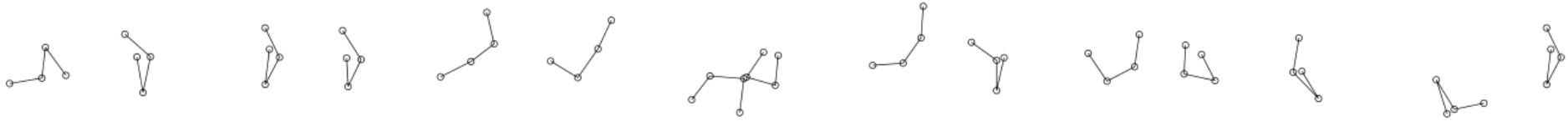


Row1 Row2 Row3 Row4



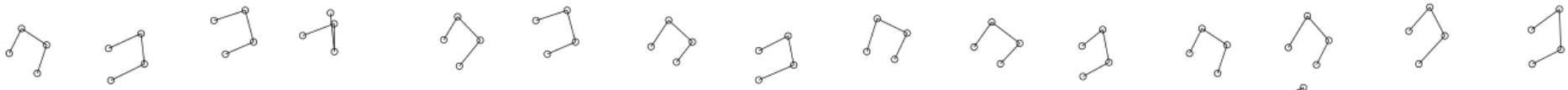
Each row is a set of representative particles after introducing a distance constraint factor.

Row1



Row2

Row3



Row4

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S-expr of Tree Factor Graphs

- To represent a tree-structure factor graph, we can use the following s-expr:

```
'(GN2(GN1
      (N1 ((attri1 value11) (attri2 value21) .. (D meanD1 varD1) (S meanS1 varS2))
          (N2 ((attri1 value12) (attri2 value22) .. (D meanD2 varD2) (S meanS2 varS2))
              (N3 .....
              )
          )
      )
   )
)
```

- GN's are the imaginary nodes for deriving high-order factors for the first few nodes.

- Recursively, each node contains
  - a list of attributes, including constraints relative to parent(s)
  - a list of child nodes

Example s-expr for a 3-node factor graph

```
12
13 '(GN2(GN1
14         (N1 ((radius 1.2) (blobbiness -0.2) .. (Distance 2 0.1) (Straightness 0 0.1))
15             (N2 ((radius 0.8) (blobbiness -0.1) .. (Distance 3 0.1) (Straightness 0 0.1))
16                 (N3 ((radius 0.6) (blobbiness -0.2) .. (Distance 2 0.1) (Straightness 0 0.1))
17                 )
18             )
19         )
20     )
21 )
```

A high scoring image corresponding to the above factor graph: