Convex Hull of Intersection of Conic Sections and Random Points

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Naturally, silkworms construct ellipsoidal cocoons by spinning silk fibers around themselves. When we consider a cocoon in two dimensions, a cocoon has an elliptical shape which is one of the conic sections. This project aims to model a new design of cocoon frame from convex hulls of the intersection points where four different conic sections are overlapped and random moving points. These four conic sections include circles, ellipses, parabolas, and hyperbolas. We have found that one of the overlapping patterns that contains the most intersections has 24 points and a symmetrical shape. The convex hull of these 24 points was used for simulating the boundary of a cocoon frame for silkworms to construct their cocoons. Other shapes of cocoon frames were simulated from moving these 24 points. We created models of cocoon frames from these convex hulls and placed the silkworms in these cocoon frames to construct their cocoons. The cocoon qualities were evaluated by the farmers based on their perfection and the length of silk thread. We have found that the most suitable cocoon frame is the standard frame that was constructed from 24 intersection points. The percentage of producing perfect cocoons from the standard cocoon frame is 65.38%, whereas the percentage of producing perfect cocoons from the traditional cocoon frame is 60.00% which yields a significant difference of 0.05. And the average length of the threads produced from the standard cocoon frames is about 1119 meters which is in the standard range of between 800 and 1300 meters.

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