Title:
Hello, I'm Bryan, and my project is on the AP Art portion of the course: drawing geometry diagrams from their problem statements.

Motivation I:
Here is a typical olympiad-level geometry problem. I've taken the liberty to bold all the typical elements -- a central triangle, some sort of circle (in this case, the circumscribing circle of ABC, or the circumcircle, among others), and a lot of special lines and points, such as the angle bisectors and the midpoints.

The first thing we need to do to actually try to solve this is to draw the diagram for this problem - after all, it's very difficult to solve a geometry problem without drawing a picture for it. As this is the AP Art portion of the course, I've drawn one up.

Motivation II:
Here is a quick hand-drawn diagram for this problem. The composition is okay - the circles for the most part look like circles, and the lines are generally straight. However, if you're actually trying to solve the problem, it would help if we could just look at the diagram and discern a statement or two that looks true, just based on the diagram. This hand-drawn diagram isn't good enough for that purpose. In particular, the lines aren't very clean, and where exactly certain circles intersect isn't very clear. **(play animation for diagram)**

In contrast, here is a diagram generated by a computer with the Asymptote language. This is much better and cleaner, and there are some facts that are true in general that might be easier to see, given that everything is drawn precisely.

Motivation III/IV/V:
For example, it certainly looks like lines AD and NM are actually parallel. It turns out proving this problem statement reduces to proving that this is true, so our diagram better make it look like these lines are actually parallel.

We might also see something going on with the second intersection of circles ADM and ABC. I've labeled it here and called it X. In my experience, drawing the second intersection of two circles can be fairly difficult, and spoiler: it's much easier to see that X is actually on line ML! Now, on the original hand drawn diagram, that was much harder to see, and noticing this and then being able to prove that this is true is actually a significant part of one possible solution to the problem.

So, if it's possible for us to create a computer-generated diagram from the problem statement, it'd be very useful.

Proposal:
My project will use supervised learning to perform natural-language processing on geometry

problems and output a diagram corresponding to the problem statement.

Methods:
In order to accomplish my project, I pulled code from a similar project done by researchers who were solving SAT geometry problems based on information from the problem statements and their diagrams. As an intermediate step, they are able to output a set of logical relations that neatly describe relationships between different geometric objects, and I intend to modify their code for SAT problems to use on olympiad problems. From there, I'll essentially map these relations into Asymptote code that can be compiled into a diagram.

Data Collection:
However, before we can talk about

I first pulled from the IMO Shortlists, because separating out the geometry problems is really easy. Here's what the

I also ended up asking on the Art of Problem Solving fora, and a user pointed me to their own site where they had

Pre-Processing:

Language:

Annotations:

Github Code: