Automatic Archery Scoring

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Abstract

We develop a system that scores arrows on an archery target using a camera. The system will replace the very time-consuming alternative of manually examining one arrow at a time.

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1. Introduction

Archery is a growing sport around the world, with competitors from the junior level to the collegiate and Olympic levels. In competition, archers line up at a measured distance from a target and attempt to fire arrows into the target center. The target consists of 10 nested concentric circles, with the innermost one worth 10 points and the outermost one worth 1 point.

One of the most time consuming tasks of archery training and competition is manually determining a score for each arrow on a target. In a typical competition, archers shoot for only 4 minutes, before having to walk to the target and determine the score - a process that takes up to 5 minutes, meaning the scoring time can consume half the competition! Since competitions usually last 2 to 4 days, a computer-assisted scoring mechanism can save quite a lot of time. Many archers don't keep score during training because it is too much of a hassle, although keeping score is one of the best ways to track progress.



Figure 1: A simple target

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Figure 2: A complex target with shadows and overlap.

We want to build a system that allows an archer with a mobile phone to take a picture and have the scores of all the arrows on the target tabulated automatically. This task is non-trivial due to the following sub-tasks:

- 1) Detection of scoring zones on the target
- 2) Detection of arrows that have entered the target at any angle
- 3) Calculating where the arrows intersect the target
- 4) Dealing with arrows obscuring/touching other arrows
- 5) Recognizing arrow shadows

6) Recognizing the owner of an arrow (each archer shoots a different color and feather type)

Since we are beginners in computer vision, we don't know the best approach to solve this problem or even if it is feasible. From brief research, we think circle detection and template matching will give us a starting point, although we don't really know how to model the arrow, the target, and their intersection point. We will probably reduce the goals down to the first 3 sub-tasks, and don't consider cases where arrows obscure/touch each other or cast sharp shadows. If we can accomplish the simple cases, we will move on to more advanced ones.