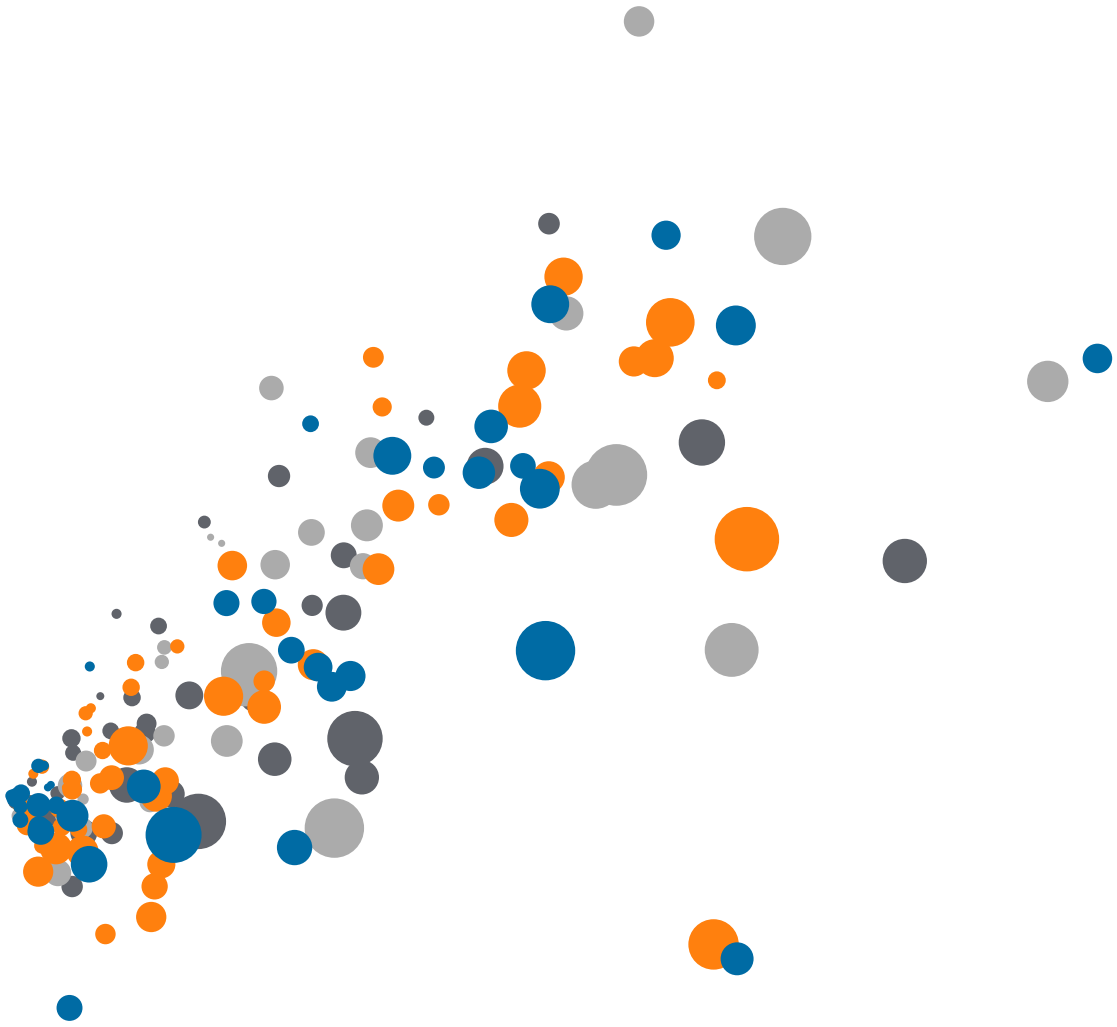


Tableau for Robotics: Introduction to Scouting

WHAT IS SCOUTING?

Scouting — all of the cool teams are doing it. Robotics teams that use a scouting strategy invariably perform better than those that don't; they have more information to make better decisions throughout the competitive season. Scouting is more than just collecting information on another team. A lead scout is a general, in charge of analyzing your opponent's weaknesses and exploiting them to win a match. While your bot may be incredible and your drivers may be experienced, until your team is using scouting data to drive your strategy, you won't be living up to your full potential.

What is scouting and how can my team do it? Use this three-part whitepaper series, produced by Tableau, to learn a step-by-step, self-directed start to a robotics scouting program, as well as find other resources to see and use data insights.

Scouting, one of the most frequently overlooked tactics, is the practice of locating important robot characteristics, measuring them, and recording and analyzing the data for more informed decisions.

WHY SCOUT?

While there are many reasons why scouting is important, all the reasons boil down to two main points. We want to:

- Play smarter during matches
- Choose the best alliance partner during finals

Just as building a good robot requires prototyping and foresight into "how to play the game," successful scouting requires background work before an effective scouting system can begin to be built. Knowing how the game will be played is an easily forgotten but important part of scouting. Once you know how the game will be played, it will be easy to avoid the scouting the less impactful elements in the game. Ultimately, knowing the game lets you pick only the most important factors of the game to collect data on.

The goal of understanding the game is to look for features that will make a bot successful. The most successful teams will try to figure out how a game is going to be played as part of their prototyping process. While they are trying to figure out how to win the game, understanding the game from a scouting perspective is more complicated. To know how to play the game smarter, scouts need to know not only the best strategies and robot features, but also how to beat them.

Many useful features to track are obvious (whether the robot can score goals, for example), others (whether the robot is easy to work with for human players) are equally important. Because the goal of scouting is to play and pick smarter, the characteristics we are looking for need to support those goals. Some examples are:

Play smarter

- Which robots do we want to play defense against?
- Which robots in our alliance should play defense?
- How do we avoid strategy overlap?
- Who should get the best autonomous position?

Choose the best team

- How to pick individuals for a well rounded team?
- Which bot is best for the strategy?
- How to pick a useful third alliance partner?

WHERE TO START

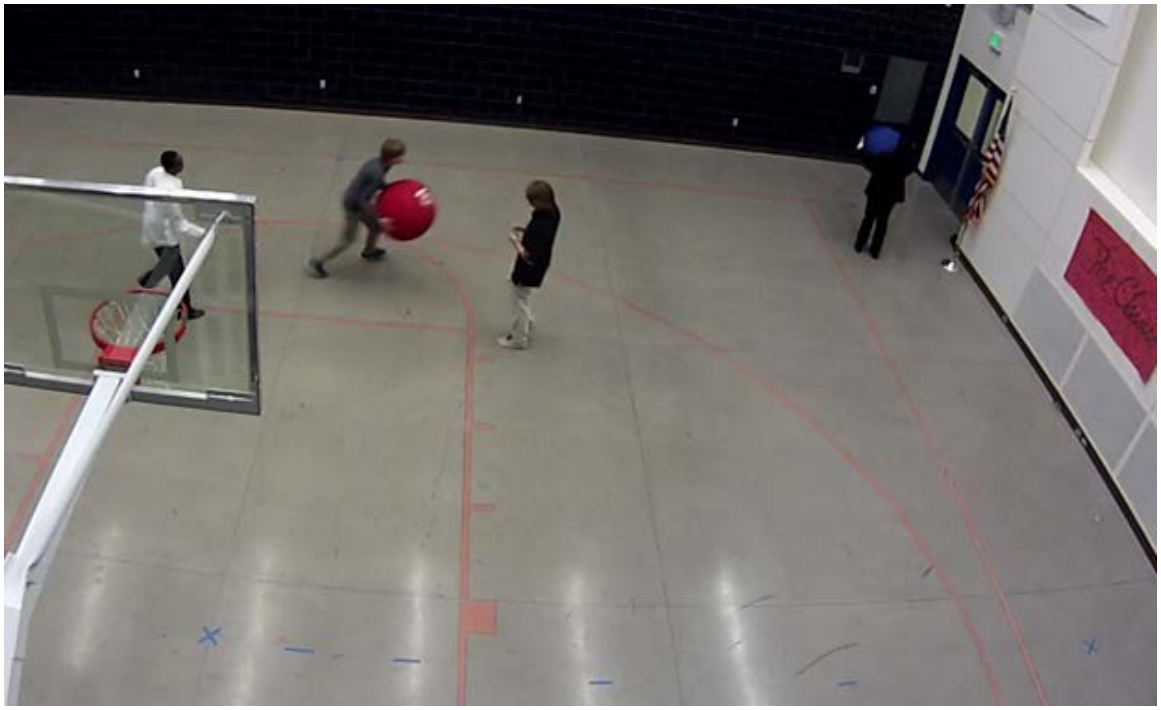
Because scouting requires such a deep level of understanding of the game, it is helpful to run through a few exercises to prototype what a game might look like. This will help show some of the less features or complications of the game. Taking notes on the features that are important and what you can measure to quantify a robot's skill at that action will help clarify what you will scout for. Anything that you want to measure is called a data field. It usually helps to start by:

Reading the rules

- What are some of the defining game rules? Look for:
  - Safe areas (places where defense can't be played)
  - Whether defending in the autonomous period is allowed
  - Whether there are actions that can only be completed in the last 30 seconds of the game, and if they be defended against

Roleplaying

- Use a large open space like a gym or practice field and mark with tape the boundaries of the field and field features. Walk through a few matches pretending to be a robot (move slower, no sharp turns, collect slower, etc.). Or do it on paper with token representations of robots and game pieces. Look for:
  - Key defensive spots
  - Important gameplay features (e.g., if a blocker or a very fast collector is important)
  - What would make a good alliance
  - Core strategies you expect to emerge



Some of the less overt characteristics to look for may not directly impact score, but are important to strategy. For example, if the rules and space favor a blocking mechanism, this will not impact your roleplaying. When it comes time to face real teams, though, you may have to change your match strategy accordingly. Another example would be knowing that robot has trouble collecting a game piece or interacting with a human player makes them a prime target for defense.

DATA TYPES

Once you've worked through some preliminary analysis of how the game will be played, you can use a table to organize the important features you find.

Action	What to look for (data field)
Shooting a goal	• Did they hit? • Did they hit secondary goal? • Did they miss? • From where did they shoot?
Special feature	• Did they use it? • How many times did they use it?
Endgame	• Did they attempt endgame actions? • What did they attempt? • How successful was it?

To make it as simple as possible to enter this data once gathering it, it is also worth considering how to collect the data. All of the data in a game can be summarized in one of six ways:

- **Count**
  - How many times an event happened
- **Short list**
  - There are a limited number of outcomes, and one outcome must always happen
- **Boolean** (yes/no)
  - Whether something happened or not
- **Location** (coordinates)
  - Where something happened
  - Note: use only one location field per period to avoid problems
- **Open string**
  - Qualitative notes (use sparingly)
- **Ranking**
  - Ordinal notes (e.g., 1-3, good/average/subpar)

To get you started, here is a list of common features in most games and suggestions for data field types:

- **Autonomous**
  - Has autonomous phase (boolean)
  - Performed autonomous special action [blocking, moving, or collecting in auto] (boolean)
  - Autonomous strategy (short list)
  - Autonomous shots (count)
  - Autonomous starting location (location)
- **Tele-Op**
  - Tele scoring and accuracy (count)
  - Position (location)
  - Tactics/role played (short list)
  - Special actions (count)
- **End**
  - Endgame attempt (boolean)
  - End game scoring (count or short list)
  - Fouls (boolean, open string)
  - Qualitative
  - Robot design features(short list, boolean)
  - Comments

Your finished table should look somewhat like the example table below.

Action	What to look for (data field)	Data field type
Shooting a goal	Hit	Count
	Hit secondary goal	Count
	Miss	Count
	From where	Location
Special feature	Did they use it?	Boolean
	How many times did they use it?	Count
Endgame	Did they attempt endgame actions?	Boolean
	What did they attempt?	List
	How successful was it?	Boolean or count

WARNING SIGNS

It is easy to get carried away when identifying important game features, but there is only so much a scout can collect in a match. If you find a data field that fits into one of the categories below, consider changing how you are collecting it, or don't collect data on it.

- **Hard or distracting to collect**
  - Robot speed, for example. While having a fast robot is useful in a match, it is also virtually impossible for scouts to collect accurately and objectively. Having a scout focus on robot speed distracts them from the other more important data points (like scoring points).
- **Can be calculated from other data**
  - Cycle time, for example. Cycle time can be calculated by dividing the shots scored by the time of tele-op period, which is easier data to collect.
- **Subjective variables** (opinions, ratings)
  - Driver skill. While knowing that a bot has a bad driver is an important piece of information, the variance on skill evaluation from your scouting team will be significant.
  - If the game requires a rating or an opinion, you will get more accurate data by using a smaller scale. Bad, neutral, good is a much better system because there is less room for opinion.

This completed data collection table will be the basis of all future scouting. It serves as an outline and thesis for the development of the remainder of the scouting program for the competition. The data collection table is also a rationale for what change scouting will be able to affect. Completing these early steps outlined in this white paper should help you convince others why your scouting method is well thought out.

Once you have thought about how to break down the game, the next steps are to develop the scouting sheets you will use to collect data and to build the database you will use to store and organize the data.