Collaborative Research Efforts for Citizen Scientists

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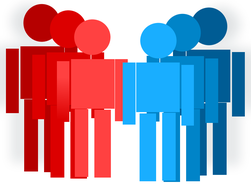
Abstract

The AAVSO's Citizen Sky project encourages participants not just to collect and categorize data, but instead to critically analyze and publish research findings. Our participants form teams of different, yet complementary skills that work together towards a common goal. Each team has a leader and a professional astronomer assigned to act as an advisor. In this work we explore the formation of teams, by what means they find research topics, and how they manage their collaborations.

How Teams Form



The Citizen Sky project differs from other citizen science projects in that our goal is to teach our participants how to collect and analyze data and prepare their results for publication in a peer-reviewed scientific journal.

A key concept to the success of CS is the formation of teams of individuals who can accomplish some research/support task. A few teams formed quickly after Citizen Sky launched in 2009, whereas other teams formed much more recently. There appear to be four primary ways teams form:

- Discussion at CS meeting peaked interest of members and they created a team. This is the most frequent cause of team formation. During the conference specific research ideas are mentioned and we encourage our participants to form groups to talk about these ideas. Teams naturally form from these groups.
- A member has a research/support idea and created the team. These teams make up the second largest subset of groups on CS. They are typically strongly driven by the team leader's interest and recruit a small number (< 5) of additional members.
- Team started by CS staff. The three teams formed by this method team to be large (> 20 individuals) with very specific research objectives.
- Team leader recruitment. This happens exclusively in schools where students learned of CS and recruited an instructor to find a research topic and serve as a team leader.

How Teams Grow

A team with one member can do research, but through collaboration the research goals are often achieved faster with more benefit to the parties involved. The following methods describe the most likely methods by which members to join a team:

- Members present at a CS conference when the team forms.
- The team leader actively encourages participation on the CS website through forum posts.
- The team leader contacts specific individuals and asks them to join.
- Members learn of the team by browsing the CS team list and joins of their own accord.

Choosing Research Topics

Finding a research topic can be quite difficult, especially if you don't have a detailed background in the field. Our team leaders came up with a list of suggestions on how one can identify potential research topics.

- Find a mentor in the field. Professionals often have several research projects in mind, but insufficient time to address all of them.
- Read journals, magazines, and AAVSO notifications for ideas. Often a common theme will develop for object selection or you might notice a question that has not been adequately answered (i.e. "How accurate are visual observations?").
- Find a star that is **not** in the AAVSO database, but has been labeled (i.e. in SIMBAD) as variable in some way.
- Do a follow-up to larger surveys to ensure stars are behaving as we think they are. V Boo, for example was found to have multi-periodic by a follow-up study.

In all of the aforementioned cases be sure to conduct a review of literature using ADS and SIMBAD. It is possible that someone has already done very similar work. If this happens, ensure that you can provide something that advances knowledge, rather than restates what is already known.

Managing a Citizen Scientist Collaboration

A team of citizen scientists is very different from a group of amateur or professional astronomers. Larger teams will often be composed of one or two "experts," three or four "intermediate," and many members with no experience in the subject at all. Every member can contribute something to the team as they learn more about the subject area, but deciding how to manage this collaboration can be quite difficult.

Team Involvement

CS has structured teams consisting of a professional liaison, a team leader, and team members. Each has a unique role:

- Professional Liaison: A professional astronomer who can provide advice and guidance to the team.
- Team Leader: Organizes the team, keeps things running forward, drives the work.
- Team members: Individuals with complementary skill sets with an interest in the project. They may not have any experience with the research topic so internal mentoring is common.

From the suggestions of team leaders, it appears a CS staff member should be directly involved with each team. In a few circumstances the professional liaison or team leader had to abandon the project, this caused the team to falter and nearly dissolve. Having a staff member assoicated with each team can reduce the impact when unexpected events happen and helps ensure the overall success of the team.

Online Collaboration Tools

There are many online collaboration tools which can help teams collaborate. A few of them are:

- Wikis and Forums: Good for quick communications or brainstorming
- Sourceforge: Excellent place to keep code
- Google Docs: Allows multiple people to work on a document simultaneously and keep track of their changes.
- Dropbox: A file sharing site for collaborations.
- Communication Tools:
  - Instant Messaging (MSN, Y, ICQ, Google Talk, etc.)
  - Internet Relay Chat (IRC) or other chatrooms
  - Skype
  - Email

Keeping Things Rolling

It is difficult to keep teams active as there are so many distractions in day-to-day life. The team leaders offer the following suggestions:

- Have the research topic be very specific, but maintain an array of challenging tasks for team members.
- Advertise the existence of various teams and their recent efforts in newsletters and/or the website.
- Conduct bi-weekly chats on IRC or Skype to keep the team unified.
- Take advantage of what other teams can offer (i.e. artwork, software, expertise).
- Place a staff member on the team and have them be in frequent contact with the leader and liaison.
- The team leader should solicit or propose a range of new issues that will appeal to the spectrum of interests and abilities in the team. This helps keep members active, and can draw back inactive members.
- When possible, meet with your team in person.
- Recognize that members will leave as their interest wanes.
- Ensure you, as a team leader, have enough time to dedicate to the project. If you can only do part of the project, find someone who can co-lead the team and take over when you need to scale back your involvement.

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Case Study: DSLR Team

Team Description

The DSLR Documentation and Reduction Team's goal is to create tutorials that describe how to use an off-the-shelf Digitial Single Lens Reflex (DSLR) camera as an accurate photometer.

Team Formation and Research Selection

Doug Welch (McMaster University) and Brian Kloppenborg discussed the use of off-the-shelf cameras for photometry at the first Citizen Sky workshop in August 2009. The prevalence of DSLR (or other raw-format cameras) makes these an inexpensive instrument for beginners, therefore the creation of instruction material could greatly benefit the community.

Shortly after the discussion with Doug, Brian created the team on CS. The four most active team members joined of their own accord within two weeks of the team's creation and have remained active since.

Managing the Collaboration

The team consists of mostly international members, therefore communication via. email and the CS website are important. Brian identified three critical areas for the tutorials (how to take images, extract instrumental magnitudes, and perform calibration) and asked the team for input on the first two steps. Team members wrote the bulk of the tutorials and then provided them to Brian as Word files which he edited and posted to the CS website. Whenever a new task needs to be completed Brian alerts members by sending emails directly to specific parties.

Results

Thus far the team has produced a set of tutorials for reducing digital images into calibrated V-band magnitudes and published a how-to article in the April 2010 issue of Sky & Telescope. At present three team members are working on a article for an education magazine. This work will discuss how DSLR photometry can be used in a secondary or undergraduate classroom.

Case Study: Astronomers without Telescopes

Team Description

The Astronomers Without Telescopes team was formed by Michael Kran with the purpose to use robotic telescopes to do astronomical research. The team was to target three primary audiences: high school students, undergraduates, and life-long learners. The objective was to increase the number of participants in photometry through the use of free access to robotic telescopes, and cloud-based software rather than to significantly advance the science.

Problems in Team Formation

Michael teamed up with Geir Klingenberg, a professional programmer with a passion for photometry. They started this collaborative project before CS existed developing a "cloud-based" photometric reduction program called Photometrica (now AAVSO's VPHOT). After the software was complete it became difficult to continue the project without a sponsor. Michael was almost alone in catalyzing this activity outside the AAVSO and he did not have the leverage to accrue additional funds needed to promote the idea as a non-profit.

The involvement with CS was to recruit people to use this software. Michael saw the success the projects like Zoo Galaxy has in getting people involved in looking at images and classifying object, but found it very difficult to replicate this result when it came to involving people in theory, measurements, and mathematics.

Recommendations

- Remove as many obstacles from the science as possible.
- Many amateurs prefer a tactile relationship to their telescope, therefore remote telescopes did not work well with this crowd.

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