A Survey of Contests in the Computer Science Community

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Abstract— **This report surveys past and present contests conducted in the computer science community. It includes material on the types of datasets used, methods for managing and conducting such contests, the various levels of participation encountered, and the typical advertising and promotion. It concludes that there are several important considerations and tactics when running a successful and beneficial contest.**

I. INTRODUCTION

Successful knowledge discovery in datasets is of great interest to a vast array of fields today. National security, medicine, genetics and finance are just a few of the areas in which knowledge discovery tools can be and have proven to be useful. One tool for helping to encourage the development of useful software applications for data exploration is the sponsorship of contests that use both real and artificial datasets.

There are several contests that exist today which are held annually, in addition to many from the past which were held only once or twice. Of interest are those with specific nuances that determine the success and popularity of the contest within the given community. The individual conference or organization running the contest, the appeal of the offered prize, the time of year the contest is held, methods for handling submissions, publicity, feedback, availability, size, and type of dataset used, are all factors in determining the size of participation and popularity of a contest.

A broad survey of past and current contests was conducted using the internet to identify as many contests as possible with the goal of discovering what the different variables are that determine the success or failure of a contest. Contest websites and the organizers own publications shed light on what they deemed to be successful strategies. Also included in the survey were informal interviews of some of the contest organizers. The findings of this three prong approach are detailed in the flowing sections. The first section introduces the sixty-four contests that were surveyed. The second section looks into the factors of successful contests and section four explores what contests use real datasets and which use synthetic datasets. Section five lists what type of problems these contests proposed, section six considers how the contest evaluated their participants and section seven lists the awards and prizes. Next we list the common challenges faced by the surveyed contests and we will follow with links to the contests and our conclusions.

II. INTRODUCING THE SURVEYED CONTESTS

The survey identified sixty-four different contests over a twelve-year time span. Of these contests, forty are held annually. Most of the contests belong to the field of data mining, but there are some such as the Visual Object Classification Challenge, DAGM, InfoVis, and VAST contests which cover visual analytics and some such as the Google programming contest which simply involve programming.

III. FACTORS IN SUCCESSFUL CONTESTS

So what exactly defines success in these surveyed contests? As mentioned previously the organizer of the contest, the prize appeal, time of year the contest is held, submission handling, publicity, feedback, availability, size, and type of dataset used, are all important factors of success. Here we explore these factors, how much control organizers have over them and which ones can be used for measures of success.

Some of the factors listed above are controlled by the organizers themselves. An example of this being the time of year a contest is held. Depending on the intended body of participants certain times of the year might be more ideal then others. For academia the summer months might be ideal unless the intended participants plan to use the contest in a classroom setting. Then the fall or spring would be more ideal. Time then is a factor controlled by the contest organizer but one that for large intended audiences it is difficult to tailor too.

Another factor that is controlled by the organizers of the contest is the offered prize or award. It is easy to see that if the prize/award offered is of worth to the intended audience it will most likely generate more interest then a prize/award that has no worth to the audience. The third

factor that can be controlled by the organizers is how the submissions are handled. Contests that have a clear and intuitive submission process tend to encourage more participation then if the submission process is convoluted and takes a tremendous amount of time and effort.

One very important factor of success of a contest that the organizers have control over is feedback to the contestants. Feedback is important to contestants to let them know where improvements can be made for the next contest (this is especially important if it is an annual contest). This is a continuation of a main goal that a contest is usually created to begin with: to encourage the development of useful software applications.

One factor that is usually not controlled by the organizer of a contest is the size of the contest. In some cases the organizer only wants a contest of a certain size and will limit the amount of participation to that size. However, in most cases the more participation in a contest the better. Participation depends significantly on the factors above and is therefore a simple way to measure the success of a contest. In annual contests increased participation year to year is used as an indicator of a successfully managed contest, as well high participation in singularly occurring contests. Other factors indicating successful contests include becoming annual, level of contribution to the targeted field, and number of accepted papers produced.

CAMDA, KDD Cup, UCSD Student Data Mining Contest, Netflix Prize, TREC, and VAST Contest (previously known as InfoVis) are six of the most prominent and successful contests that have run in the past. With the exception of the Netflix Prize contest, these contests are annual. Participation levels within these contests range from only ten teams for the VAST Contest in 2007 to over four thousand teams participating in the Netflix Prize competition – a competition which has been running and accepting submissions since 2007.

Certainly a factor in the success of the Netflix Prize is in their ability to offer a one million dollar grand prize and a ten thousand dollar prize for a slightly smaller achievement. CAMDA and UCSD Student Data Mining Contest offer a cash prizes ranging from four hundred to one thousand dollar. VAST Challenge, TREC, and KDD Cup offer only formal recognition and the opportunity to publish papers.

An informal interview with an organizer of the CAMDA contest reveals that one of their biggest challenges in running such a contest has been "to compile a novel test data set early enough before the contest conference for participants to have a reasonable amount of time for sufficiently complex analysis", a challenge the VAST Contest faces as well. An organizer

of the 2008 Data Mining Competition: Discovering Knowledge in NHANES Data, attributes low levels of participation to the importance of the relevance of a dataset to an individuals particular area of study or research. To attract more participants in the coming years, organizers plan to allow participants to enter the contest using a dataset of their own choosing in the future.

IV. SYNTHETIC VS. REAL DATA

Using real and synthetic datasets has both perks and downfalls. Real world datasets can sometimes allow savvy individuals to use them for unscrupulous purposes. Synthetic datasets take time to generate and sometimes do not resemble real world data as closely as contestants would like.

VAST (formerly InfoVis), DAGM 2007, Feature Selection Challenge, NIPS 2003 Workshop on Feature Selection, PAKDD Competition, SAS Conference, UCSD Student Data Mining Contest and TREC are contests that make use of synthetic datasets. VAST obtains their data from PNNL threatstream. The Feature Selection Challenge datasets were created by NIPS themselves.

CAMDA, CoIL Competition, 2008 Data Mining Competition: Discovering Knowledge in NHANES Data, Agnostic Learning vs. Prior Knowledge Challenge, BCI Competition, boards.ie SIOC Data Competition, CLIMA, Data Mining Cup, Google Programming Contest, ICCV2005 Computer Vision Contest, ECML PKDD, IEEE ICDM Data Mining Contest, INFORMS, JSAI KDD Challenge, KDD Cup, MindTrek, Netflix Prize, NN5, Performance Prediction Challenge, Physiological Data Modeling Contest, SIAM Text Mining, UCF Data Mining Competition and Visual Object Classes Challenge are competitions that use real world datasets.

V. CONTEST PROBLEM

The type of task(s) that each contest requires varies substantially from one contest to another. The ABU Robocon contest has contestants create a robot where at least one part of the competition is autonomously controlled by a user written program. The ACM International Collegiate and North Central North America programming contests each give ten to twelve problems which has to be done within a time constraint The Agnostic Learning vs. Prior Knowledge contest asks contestants to design a stand-alone program that outperforms a program-analyst approach. The AMIA (American Medical Informatics Association) Data Mining Competition asked contestants to produce

meaningful information from the information provided. BCI (Brain Computer Interfaces) Competition presents the contestants with a number of different datasets and asks them to answer specific questions, for example "Estimate which letter the subject was paying attention to." The BEST Robotics Competition creates a challenge that competitors must construct a robot in which every team has identical kits and materials to complete certain tasks varying over years. The Boards.ie SIOC Data Competition asks contestants to submit an "interesting creation" based on their data set. The Google Programming Contest takes this approach as well. Botball is a competition where they autonomously achieve goals set within scoring criteria. CAMDA asks that contestants use the dataset to develop methods for biological and goal oriented critical analysis. The Centennial Challenges gives a set of five challenges where the goal is to find the most innovative solutions. The CLIMA Contest asks contestants to design and implement a multi-agent system for a give situation and creating an executable implementation. The CoIL Challenge asks challengers to predict potential caravan insurance customers to avoid sending spam to non-buyers. The DAGM competition asks teams to develop algorithms that use images to detect texture defects. The DARPA Urban Challenge wants an autonomous ground vehicle that drives and navigates completely on its own with no driver or control allowed. The Data Mining Contest: Uncover Criminal Activity in a real Fraud case asks contestants to find a form of complicated fraud through programming. The 2008 DMC (Data Mining Cup) Competition asked teams to examine the personal data of participants of a German lottery to predict how long players would participate. Defconbots is a competition based on the United States Armed Forces' Defense Condition. This competition has competitors create an autonomous robot that fulfills objectives such as delivering objects or shooting targets. The Denison Spring Programming contest has problems with different themes are assigned and each contestant must complete six questions within four hours. The ECML PKDD asked challengers to detect spam in social book marking systems. They wanted to prevent links from attracting people to the advertising sites and the goal was to predict spammers or not. ELROB challenges current technology to do objectives such as unmanned robots traveling over realistic terrain or acting in a realistic situation The EUNITE Competition asked competitors to improve Customer Intelligence in the bank and analyze behaviors to predict if the client will remain with the bank or not. NIPS 2003 Workshop on Feature Extraction tasks contestants to "find feature selection algorithms that significantly outperform methods using all features". The Fire fighting contest requires the contestant to create

an autonomous robot map out an area and extinguish a flame on a candle. FIRST Robotics competition assigns a situation relating to the challenge and teams must create a robot within a budget to respond to hand built and programmed controls and have an autonomous program. The IARC wants a small autonomous aircraft capable of navigating a maze and obstacles in a small time period. The ICCV Challenge in 2005 asked participants to use a dataset consisting of a "set of images taken at known GPS locations to find GPS images of test images at unknown locations but roughly the same area (view overlap)". ICDAR 2009 asks to evaluate realistic data sets with layout analyses to identify certain regions within the data set. The IEEE ICDM Data Mining Contest uses a dataset that contains information pertaining to a person holding a wireless device and asks the participants to estimate their location in the building. The IEEE Visualization Contest asked contestants to display their visualization techniques with given data sets. The IGVC had competitors to design and construct an unmanned, autonomous vehicle that can navigate an obstacle course and stay within a speed limit. In the Informs Data Mining Contest, participants are given a set of data pertaining to patients in hospitals and infection. They are asked to use that dataset to design a method to identify from a different dataset the patients that will contract an infection (MRSA), and to design a realistic cost model and use it to maximize total cost savings (with respect to treating patient infections). The JSAI KDD asked challengers to evaluate any significant knowledge of detecting and predicting meningoencephalitis diagnosis. The KDD Cup challenge varies from year to year, this year they have asked about Customer Relationship Management and marketing strategies. In past years they have asked about things such as medical data mining or things similar to the Netflix Prize contest. The SAS Annual Data Mining Contest gives out a hypothetical but common business problem. The MATLAB programming contest asks for visualizations of the Peg Solitaire contest. MEMOCODE has a software design contest. Micromouse asks competitors to create a fully autonomous robot to navigate a maze. The Nokia Ubimedia MindTrek competition asked competitors to create innovational technologies using computing to make intelligent media. The Netflix Prize asked competitors to improve the algorithm for improving movie recommendations. The Neural Forecasting Competition asked challengers to predict a set of time series and progress in modeling neural networks for forecasting. The Ontology Alignment Evaluation Initiative wants to identify areas where alignment is weak or strong. The Performance Prediction Challenge asked challengers to predict models and select the optimum models. The

Physiological Data Modeling Contest asked contestants to predict information after being given a dataset. The PAKDD Data Mining Competition asks user about various marketing such as mortgage customers or predicting cell phone users to switch to 3G networks. Robocup holds competitions where competitors create a team of autonomous soccer robots and compete against other teams. Robofest has competitors compete missions with fully autonomous robots. Robogames hosts over 70 different events from acrobatics to sumo wrestling. The SIAM (Society for Industrial and Applied Mathematics) Text Mining Program asks competitors to develop text mining algorithms that label documents to precision. The SQLServerPedia contest wanted to find a way to help Data Base Administrators with data mining. The UAV Challenge for unmanned airborne vehicles wants challengers to perform a search and rescue scenario. The University of Central Florida's Data Mining Competition asks competitors to develop a predictive model that can generate potential responders in mailing campaigns. The University of California, San Diego's Data Mining Contest has contestants maximize precision of binary classification and then repeat with predictive information. MEMOCODE software/hardware co-design contest wanted to have an encrypted database of records sorted as fast as possible which includes decryption and proper indexing and then re-encrypted. The VAST challenges asks both quantitative and qualitative questions pertaining to it's datasets, requiring amongst other things lists of individuals, specific times, or locations when things occur, as well as free text explaining they why's and how they arrived at their answers. The Visual Object Classes Challenge asked to create a program that will recognize objects within a realistic scene

VI. EVALUATION

Each contest evaluates entries in a different way, using various quantitative or qualitative methods. Some contests combine the two types of evaluation for a more rounded approach to their evaluation process. Some contests that evaluate entries quantitatively provide almost immediate feedback to the participants while others take weeks.

VAST Contest, INFORMS Data Mining Contest, use both metrics and a peer review process to evaluate entries. CAMDA, AMIA 2008 Data Mining Competition, boards.ie SIOC Data Competition, Google Programming Contest, use qualitative evaluation techniques.

Agnostic Learning vs. Prior Knowledge, BCI Competition, DAGM 2007, Data Mining Cup, NIPS 2003 Workshop on Feature Extraction, ICCV Computer Vision Contest, IEEE ICDM Data Mining Contest, KDD Cup, Netflix Prize, UCSD Data Mining Contest, and Physiological Data Modeling Contest use quantitative methods to evaluate submissions.

Criterion used to evaluate entries that were judged qualitatively include utility, importance of output, elegance of design, scalability, clarity, efficiency, portability,

Quantitative criteria include various error measures, such as precision, in addition to other methods evaluation against established statistical benchmark methods, evaluation against benchmark expert software packages, evaluation against standard software packages,

VII. AWARDS AND PRIZES

There are a handful of different types of prizes awarded to winning teams and participants depending upon the contest. These include cash, publications, formal recognition, opportunities to present, and invitation to conferences. Other various prizes are offered less consistently across all competitions such as gift certificates, expensive products, visits to desirable locations or even items such as a remote controlled helicopter or t-shirts.

Contests that offer cash significantly outnumber the others and can be divided into three categories, those that offer less than 500, those that offer between 500 and 2000, and those that offer over 2000. The AMIA and Neural Forecasting competitions have prize of two hundred dollars or less and one hundred fifty dollars respectively. Contests such as the ICCV, IEEE ICDM, UCF Data Mining Competition, UCSD Data Mining Competition and MEMOCODE all offer amounts of cash differing from one-thousand dollars to five-hundred dollars. The DAGM, Data Mining Cup, Google Programming, KDD Cup, MindTrek, and the Netflix Prize are all contests with major cash prizes. The DAGM had given a total of 15300 Euros out; the most being given to a single person was 5000 which is about seven-thousand dollars. The Data Mining Cup also gave out Euros but the most it gave out was 2500 Euros. The Google Programming contest allowed the winner a visit to Google and a payment of ten-thousand dollars. The KDD Cup gave out 3500 Euros to the winner and close amounts to other contestants. The MindTrek Competition gave out about 7000 Euros. The Netflix Prize offered one million dollars to anyone who could improve the algorithm in finding movies customers may like.

Many contests, instead of offering a cash reward or sort, offer a publication or a chance to present their conclusion and result at a conference. Other contests offer items or all expense trips. The Agnostic Learning vs Prior Knowledge, Feature selection, CLIMA, SAS M2008, Performance Prediction Challenge, PAKDD

competitions and the Visual Object Classes Challenge all offer a publication if won. The VAST Challenge, the SIAM competition, SAS M2008 and MEMOCODE awarded contestants with an invitation to present their results at a conference. The ECML PKDD, EUNITE and the SQLServerPedia contests gave items instead of either of the above. ECML PKDD gave out cell phones and some remote controlled helicopters. EUNITE gave out all expenses paid travel including fees and hotels. SQLServerPedia gave out T-shirts.

VIII.   COMMON CHALLENGES FACED BY THE SURVEYED CONTESTS

IX.   INFORMATION OF SURVEYED CONTESTS

Contest Name	Support	Years	General Area	Link
ABU Robocon	ABU	Annual 2000-2009	Robotics Programming	http://www.official-robocon.com/
ACM International Collegiate Programming Contest	IBM	Annual 2005-2009	Programming	http://cm.baylor.edu/welcome.icpc
ACM North Central North America Programming Contest	IBM	Annual 2005-2008	Programming	http://acm.unl.edu/contest/

Agnostic Learning vs. Prior Knowledge	Pascal Challenge	Once 2007	Data Mining	http://www.agnostic.inf.ethz.ch/index.php
AMIA	AMIA	Annual 2007-2009	Data Mining	http://www.amia.org/mbrcenter/wg/kddm/contest.asp
Artificial Neural Network & Computational Intelligence Forecasting Competition	BISlab	Annual 2004-2009	Neural networks	http://www.neural-forecasting-competition.com/index.htm
BCI Competition	IEEE	Once 2003	data mining	http://ida.first.fhg.de/projects/bci/competition_iii/
BEST Robotics	IGUS	Annual 1993-2009	Robotics	http://www.bestinc.org/
boards.ie SIOC Data Competition	Science Foundation Ireland	Once 2008	data mining	http://data.sioc-project.org/
Botball	NASA	Annual 2005-2009	Autonomous Robotics Programming	http://www.botball.org/
CAMDA	Tecan Vienna Agilent	Annual 2000-2009	Data Analysis	http://camda2009.bioinformatics.northwestern.edu/
Centennial Challenges	NASA	Annual 2005-2009	Robotics	http://centennialchallenges.nasa.gov/

The CLIMA Contest	SOCS	Once 2005	data mining	http://clima.deis.unibo.it/contest.html
CoIL Challenge	The Insurance Company	Once 2000	data mining	http://www.liacs.nl/~putten/library/cc2000/report2.html
DAGM 2007	Olympus	Once 2007	data mining	http://klimt.iwr.uni-heidelberg.de/dagm2007/prizes.php3#industry
DARPA Grand Challenge	SRS Technologies	Annual 2004-2007	Robotics/Programming	http://www.darpa.mil/grandchallenge/index.asp
Data Mining Contest: Uncover Criminal Activity in a Real Fraud Case	Data Shaping	One Time	Data Mining	http://www.datashaping.com/contest14005.shtml
Data Mining Cup	PRUDSYS	Annual 2002-2009	Data Mining	http://www.data-mining-cup.com/
DefconBots	RobotWarez	Annual 2004-2009	Autonomous Robotics Programming	http://defconbots.org
Dension Spring Programming Contest	Denison University	Annual 1991-2009	Programming	http://www.denison.edu/academics/departments/mathcs/denison_spring_programming_conte.html

Duke Climing Challenge	Duke University	Once 2008	Autonomous Robotics Programming	http://robotics.pratt.duke.edu/roboclimb
ECML PKDD and PKDD	EOARD and Google	Annual 2001-2009	Data Mining	http://www.kde.cs.uni-kassel.de/ws/rsdc08/
ELROB	German Federal Armed Forces	Annual 2006-2009	Robotics	http://www.elrob.org/
EUNITE	Information Society Technologies Program	Twice 2001-2002	Data Analysis and Prediction	http://neuron.tuke.sk/competition2/
Feature Selection Challenge	Boeing Company	Once 2003	data mining	http://www.clopinet.com/isabelle/Projects/NIPS2003/#challenge
Fire Fighting Contest	Versa	Annual 1993-2009	Robotics Programming	http://www.trincoll.edu/events/robot
FIRST Robotics	NASA	Annual 1992-2009	Robotics	http://www.usfirst.org/what/frc/default.aspx?id=366
Google programming contest	Google	Once 2002	Programming	http://www.google.com/programming-contest/index.html#rules
ICCV Computer Vision Contest	IEEE	Biennial 1997-2009	Computer Visualization	http://research.microsoft.com/iccv2005/Contest/

ICDAR Page Segmentation Competition	A2iA	Biennial 2001-2009	Algorithmic Analysis Tasks	http://www2.computer.org/portal/web/csdl/doi/10.1109/ICDAR.2003.1227750
ICWSM Data Challenge	AAAI	Annual 2007-2009	Informational Analysis	http://www.icwsm.org/2009/data/
IEEE ICDM	IEEE	Annual 2007-2009	Data Mining	http://www.cs.uu.nl/groups/ADA/icdm08cup/
IEEE Visualization Contest	IEEE	Once 2004	Visualization	http://vis.computer.org/VisWeek2009/vis/contests.html
INFORMS	ILog	Annual 2008-2009	data mining	http://informsdataminingcontest.googlepages.com/
InfoVis	IEEE	Annual 2003-2005 becomes VAST	Visual analytics	http://www.infovis.org/
Intelligent Ground Vehicle Competition	Department of Defense	Annual 2006-2009	Autonomous Robot Programming	http://www.igvc.org/
International Aerial Robotics Competition	JAUS	Annual 1995-2009	Robotics	http://iarc.angel-strike.com/
JSAI KDD Challenge	IEEE	Once 2001	data mining	http://wwwada.ar.sanken.osaka-u.ac.jp/pub/washio/jkdd/jkddcfp.html
KDD Cup	Pascal2	Annual 1997-2009	Data Mining	http://www.kddcup2008.com

LSHTC	Pascal2	Once 2009	Text Classification	http://lshtc.iit.demokritos.gr/
MATE ROV Competition	MATE	Annual 2002-2009	Robotics	http://www.marinetech.org/rov_competition/2008/index.php
MATLAB Data Visualization Contest	MATLAB	Annual 1990-2009	Visualization	http://www.mathworks.com/contest/datavis/home.html
MEMOCODE HW/SW Co-design Contest	ACM SIGBED, ACM SIGDA, IEEE CAS	Annual 2007-2009	Design	http://memocode.irisa.fr/2008/
METU Robotics Days	Gate Electronik	Annual 2003-2009	Robotics	http://www.odturobotgunleri.org.tr/eng/index.php
Micromouse	IEEE	Annual 2001-2005	Autonomous Robotic Programming	http://micromouse.cs.rhul.ac.uk/
MindTrek	Nokia	Annual 2007-2009	Innovative Programming	http://www.mindtrek.org/2009/competition
Netflix Prize	Netflix	Once 2006	data mining	http://www.netflixprize.com/index
Neural Forecasting Competition	BISlab	Annual 2006-2009	Neural Forecasting	http://www.neural-forecasting-competition.com/
Ontology Alignment Evaluation Initiative	OAEI	Annual 2004-2009	Identify algorithm alignment	http://oaei.ontologymatching.org/2009/

PAKDD Data Mining Competition	NECTEC	Annual 1997-2009	Data Mining	http://lamda.nju.edu.cn/conf/pakdd07/dmc07/
Performance Prediction Challenge	National Science Foundation	Once 2006	data mining	http://www.modelselect.inf.ethz.ch/datasets.php
Physilogical Data Modeling Contest	BodyMedia Incorporated	Once 2004	data mining	http://www.cs.utexas.edu/users/sherstov/pdmc/
Rat's Life	ICEA Project	Once 2007	Autonomous Robotics Programming	http://www.ratslife.org/index.php?option=com_frontpage&Itemid=1
Robocup	Citizen Micro Human Tech	Annual 1997-2009	Robotics	http://www.robocup.org/
RoboFest	TARDEC	Annual 1999-2009	Robotics	http://www.robofest.net/home.htm
RoboGames	BattleBots:Team Toad	Annual 2004-2009	Robotics	http://www.robogames.net/
SAS Data Mining contest	Business Insight	Annual 2007-2009	Data Mining	http://www.sas.com/events/dmconf/contest.html
SIAM Text Mining Competition	NASA Ames Research Center	Once 2007	Text Mining	http://www.cs.utk.edu/tmw07/
SQLServerPedia Contest	SQL ServerPedia	Once 2009	data mining	http://sqlserverpedia.com/blog/sqlserver-management/contest-data-mine-the-dmvs/

UAV Outback Challenge	ARCAA	Annual 2007-2009	Robotics	http://www.uavoutbackchallenge.com.au/uavoutbackchallenge/intro/
UCF Data Mining Competition	BCBSFL	Once 2008	data mining	http://dms.stat.ucf.edu/competition08/home.htm
UCSD	Fair Isaac Corp	Annual 2004-2009	Data Mining	http://mill.ucsd.edu/
UIL Computer Science	UIL	Annual 1999-2009	Written Exam/Programming	http://www.uil.utexas.edu/academics/computer_science/index.html
VAST Challenge	NSF/IARPA	Annual 2006-2009	Visual Analytics	http://www.cs.umd.edu/hcil/VASTchallenge08/
Visual Object Classes	Pascal	Annual 2005-2009	Visual Analytics	http://pascallin.ecs.soton.ac.uk/challenges/VOC/

X. CONCLUSION

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