CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Marcus A. Burke

Project Number
J1401

Project Title
To Switch or Not to Switch? That Is the Question: The Monty Hall Problem

Abstract

Objectives/Goals
WHEN ASKED IF YOU WANT TO SWITCH TO ANOTHER DOOR SHOULD YOU SWITCH OR STAY WITH YOUR FIRST CHOICE? WILL YOU HAVE A BETTER CHANCE OF WINNING?

HYPOTHESIS:I BELIVE PEOPLE WHO STAY WITH THEIR ORGINAL ANSWER WILL WIN MORE THAN THOSE WHO SWITCH BECAUSE WHEN ON OF THE DOORS WITH THE GOAT IS OPEN ANS SHOWN THEN YOU HAVE A 50/50 CHANCE THAT YOUR DOOR HAS THE CAR.

Methods/Materials
1. EXPERIMENT CONTROLLER TO ADMINISTER THE GAME
2. PLAYERS (RECOMMENED UP TO 30 BUT CAN BE LESS) TO PLAY A TOTAL OF 100 TIMES
3. PEN
4. SPREADSHEET FOR DOCUMENTING DATA
5. 3 CARDS WITH ONE HAVING A PICTURE OF A CAR AND THE OTHER TWO CARDS WITH A GOAT.
6. DISPLAY MADE OF WOOD WITH THREE DOORS TO PLAY THE GAME

Conclusions/Discussion
CONCLUSIONS, WHEN ASKED IF YOU WANT TO STAY OR SWITCH TO ANOTHER DOOR SHOULD YOU SWITCH OR STAY WITH YOUR FIRST CHOICE? I HAVE FOUND THROUGHT THE EXPERIMENT THAT YOU WIN MORE OFTEN IF YOU SWITCH YOUR DOOR. WILL YOU HAVE A BETTER CHANCE OF WINNING? THE ANSWER IS YES BECAUSE YOUR ODDS INCREASE. WHAT ARE YOUR ODDS OF WINNING STATISTICALLY, YOUR ODDS OF WINNING BEFORE YOU SWITCH IS 33% CHANCE OF PICKING THE WINING DOOR BUT SWITCHING DOORS DOUBLES YOUR ODDS TO 66% CHANCE OF WINNING. MY RESULTS GAVE ME SIMILAR NUMBERS,A 38% CHANCE OF WINNING WITHOUT SWITCHING ANS A 685 chance of winning if you do switch i expect that if i do more trials the results would be oftern more close to 1/3 and 2/3.

Summary Statement
MY PROJECT IS ABOUT A GAME HOST WHO MADE IT BIG AND SHOWED YOU HOW YOUR ODDS WOULD BE TO SWITCH OR NOT TO SWITCH

Help Received
MY DAD HELPED MY MAKE THE DOORS GAME. MY MOM HELP CHECK SPELLING AND BOUGHT THE BROAD

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Benjamin Y. Chen

Project Number

J1402

Project Title

A Study on Alternative Methods of Cell Counting

Abstract

Objectives/Goals

The purpose of this project was to determine if there existed a superior algorithm for counting cells using image processing. With image processing, images of cells that usually would have taken many minutes to count now take fractions of seconds. My hypothesis was that using edge detection instead of a threshold in a cell counting program, greater accuracy and precision would be achieved.

Methods/Materials

Using a threshold is the most commonly used algorithm in a cell counting program, but I believed using edge detection could yield better results. Two similar programs in MATLAB were prepared, each using one of the two algorithms and variables idealized for the algorithm. Two sets of cell images, one low contrast blood cells and the other high contrast colon cancer cells, from the BBBC (Broad Bioimage Benchmark Collection) were used to test the accuracy and precision of each algorithm.

Results

In the high contrast image set, edge detection came in with an average accuracy of 93% and a standard deviation of 4.8%, while thresholding performed perfectly with an average accuracy of 99% and a standard deviation of 0.4%. But in the low contrast image set, edge detection again performed well with an average accuracy of 94% and a standard deviation of 4.4% , while thresholding did rather poorly with an average accuracy of 68% and a standard deviation of 20.3%.

Conclusions/Discussion

The data showed that edge detection outperformed thresholding significantly in the low contrast image set, suggesting that it would be much more suitable for images with low contrast, while thresholding would be more optimal with high contrast images. Thresholding was used as it was the best algorithm at separating background and foreground, while edge detection outlines objects in the foreground, making it more ideal when the contrast between background and foreground is too low to use a threshold. Therefore, the hypothesis was partly true.

Summary Statement

The purpose of this project was to determine if there existed a superior algorithm for counting cells using image processing.

Help Received

Parents helped construct display board

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Aaron O. Feldman

Project Number
J1403

Project Title
Saving Lives One Swimmer at a Time

Abstract

Objectives/Goals
The objective of this project is to develop a computer system that can reliably detect when a swimmer is underwater and possibly drowning.

Methods/Materials
A video was taken with the swimmer under water as well as above the water. The video was split up into still images. Then a program written in Python processed the images. The program compared a baseline image in which the swimmer was known to be absent/not visible to other images, attempting to detect whether the swimmer was visible in the other images. For a given image, the program concluded that the swimmer was visible if and only the region (a 50x100 pixel box) with the largest summed differences exceeded a specified threshold.

Sometimes when the swimmer is submerged, the error level exceeds the threshold because the program has detected moving lane lines. An improved program was developed that minimizes the impact of this or similar motion. The new program modifies the evaluation image by swapping closely-spaced pixels to minimize error levels, essentially moving the lane lines back to their original location in the baseline image.

Results
As expected, images with the swimmer above water have a higher error level than those with the submerged swimmer; although it can minimize or eliminate the errors associated with moving lane lines, pixel-swapping cannot eliminate the error associated with the swimmer because the swimmer is not visible in the baseline image.

Conclusions/Discussion
It is possible to set a threshold which can be compared against error levels to accurately determine whether the swimmer is not visible and hence underwater.

Summary Statement
In this project, a computerized image processing system was developed to reliably detect when a swimmer is underwater and possibly drowning.

Help Received
Father helped teach Python programming language

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Aayush Gupta

Project Number

J1404

Project Title

The Effect of Features on Dementia Detection Accuracy

Abstract

Objectives/Goals

13% of people above age 65 have dementia. The objective of my project is to detect dementia presence from MRI data through machine learning. In my work, I used the OASIS dataset. This dataset includes MRI data for 436 patients and other features for each patient, like gender and dementia rating.

Methods/Materials

First, I read the MRI data into MATLAB. My MATLAB code counts different voxels and computes features like the amount of white matter in the brain. I designed a new feature for symmetry along various axes that weights different brain matter equally. Then, using a Python program, I combine these features with the feature values from the original dataset into a form that I can input into a machine learning algorithm.

Results

The machine learning algorithm, called Support Vector Machine (SVM), takes the feature values and graphs it. Then, it finds a plane of best fit separating the dementia patients and the non-dementia patients. This algorithm is applied repeatedly to different test sets, and the accuracy is recorded and averaged and found to be 86.3%.

Conclusions/Discussion

My accuracy of detecting dementia is 86.3%, 1.6% higher than previous studies. This result is obtained primarily due to my new symmetry feature. My work can help develop radiologist's tools that can filter and prioritize dementia cases requiring further human review.

Summary Statement

My project detects presence of dementia in humans from MRI data using machine learning

Help Received

My advisor Mr Jason Robertson helped me find the OASIS dataset. My father helped me install Matlab and learn Python and machine learning.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Jeremy P. Hanlon

Project Number
J1405

Project Title
Solving It! A Computer Programming Language that Solves Linear and Quadratic Equations and Shows Its Work

Abstract

Objectives/Goals
The purpose of my Science Fair invention is to develop a computer programming language that solves linear and quadratic equations and shows its steps in the process of solving them. The goal is to solve equations quicker and more accurately and to be able to use the invention to learn or teach others.

Methods/Materials
Materials:
Computer with Python programming language installed
Text editor

Methods/Steps
(abbreviated below- more detailed steps are summarized on my board and detailed in my report):
Input programming code/script.
Run program script.
Test linear and quadratic equations.
Fix errors in programming.
Retest equations.

Results
My invention correctly solves linear and quadratic equations and shows its steps involving in solving the problems. I tested many different equations, fixed errors I found in my coding/programming, and ran the program more than 200 times.

Conclusions/Discussion
The results of my Science Fair inventioned achieved my goal and purpose. The language I developed solves linear and quadratic equations and shows its work. My invention is useful because someone can use it to check homework, learn how to solve these types of equations, and solve mass equations quickly and accurately. It was challenging and fun for me to work on this invention. In the future, it would be useful to expand the invention to run more types of math problems (like exponential equations) and to enable it to read handwriting. This type of invention can be useful to others who are working on projects that require computer programming solutions.

Summary Statement
My Computer Science invention is a programming language that solves linear and quadratic equations and shows the process steps involved in getting to the solution.

Help Received
A tutor reviewed my programming code, offered suggestions on simplifying and testing the code, and reviewed my written report.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Ryan T. Lehmkuhl

Project Number
J1406

Project Title
Are Your Passwords Secure over Public Wi-Fi?

Abstract

Objectives/Goals
Do you ever give a second thought to the fact that every time you use WiFi you could be sending your passwords not to the Internet, but to a hacker? My hypothesis is that if you use public Wifi, then your passwords are at risk of being obtained by hackers unless you use HTTPS encryption or a VPN. I will be testing this hypothesis and proving whether or not you are secure. If you are not, I will continue testing to find a way to protect and make yourself secure. My overall goal for this project is to make people aware of the danger they could be putting themselves in everytime they use WiFi at Starbucks, or the airport, and give a solution to that danger if it exists.

Methods/Materials
I tested my hypothesis by setting up my home WLAN to replicate an unsecured public WiFi hotspot (ie. Starbucks). I got access to two computers and made one computer the victim, and the other the hacker. I connected both computers to the unsecured network I had set up. I then proceeded to log into various fake accounts I had made on differing browsers on the victim computer with or without a VPN. Meanwhile, I tried to obtain the passwords through Man-in-the-Middle (MITM) Sniffing and MITM SSLStrip attacks from the hacking computer; recording all my results.

Results
The results were scary. I was able to obtain any password through HTTP on every browser easily by running a MITM Sniffing attack, but when using a VPN the passwords could not be obtained. When running a MITM SSLStrip attack, I was able to successfully obtain the passwords for Facebook, Huffington Post, and Business Insider on all browsers. Gmail and Paypal passwords were only obtained when the target was using Internet Explorer or Safari. The Twitter password was only obtained when using Internet Explorer, Google Chrome, or Safari. When using a VPN, no passwords were successfully acquired.

Conclusions/Discussion
In closing my project was a success. I have proved that a user#s passwords are not secure over public WiFi. I have also proved that there are options to secure yourself. Whether it#s having your email contacts used for phishing, your money in the bank being withdrawn, or even identity theft, using public WiFi without taken measures to secure yourself has dire ramifications. This project, if successful, will show people the hard statistics of risk involved in public WiFi, and teach and motivate them to protect their passwords and their security.

Summary Statement
The purpose of this project is to prove whether or not a hacker can obtain your passwords over public, unsecured WiFi, and if there is a way to protect yourself.

Help Received
My dad helped me form a solid hypothesis

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Alexander R. McGrath

Project Number
J1407

Project Title
Playing the Odds: An Optimal Strategy for Draw Poker

Abstract

Objectives/Goals
In my experiment I used probability theory to develop an optimal strategy chart for five card draw poker. I wanted to find out more about the effectiveness of scientifically produced strategy charts. I also wanted to see if the actual distribution of poker hands dealt was similar to the expected distribution.

Methods/Materials
I created a strategy chart using combinatorial mathematics and statistical simulation. The chart was tested against a variety of human opponents and sample strategies. I played a total of 500 hands. I drew cards based strictly on my strategy chart and my opponent drew cards based on his or her personal strategy. The winning outcome and the ranks of each starting hand were recorded.

Results
The data has shown that my strategy chart will, over the long run, tend to beat most players and most other strategies. Additionally I found that the actual distribution of hands received matched the expected probability distribution (with 92.4% confidence). If I had experimented with more hands, I believe that the confidence would be even higher.

Conclusions/Discussion
My experiment has shown that probability theory can be used to your advantage in games such as draw poker or blackjack by creating and using a consistent strategy chart to aid you in your play.

Summary Statement
In my project I used probability theory to develop an optimal strategy chart for five card draw poker and I validated my chart through statistical simulation and live experimentation.

Help Received
Parent provided help with statistical graphics.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Adam Z. Noworolski

Project Number
J1408

Project Title
Who Can Solve a Maze Faster, a Computer or a Human?

Abstract

Objectives/Goals
To discover who can solve increasingly difficult mazes faster, a computer or a human.

Methods/Materials
First I did some research on some computer algorithms that solve mazes. Then I created a computer program that solves mazes, using the wall-follower algorithm, with Scratch. Then, I ran the computer through three increasingly difficult mazes, five times. I recorded those times in data tables and graphs. Then, I tested humans through those same mazes, five times. I recorded and graphed this data as well.

Results
On the first maze, humans solved the maze much faster than the computers but on the second and third mazes, the computer beat the humans.

Conclusions/Discussion
This data is this way because humans try to look throughout the maze and try to reach the exit by the shortest visible path. On the first maze, the path is clearly visible, so the human traverses it almost instantly. The computer has to traverse all around the maze before it finally reaches the end. On the second and third mazes, the human cannot see a visible path to the end, so he guesses. When he guesses the wrong path, he has to backtrack. The computer can backtrack much faster than the human, so with mazes with multiple dead-ends; computers would typically solve those mazes faster.

Summary Statement
Comparing Humans and Computers on solving increasingly complex mazes.

Help Received
Parents bought poster board

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Sara M. Patz

Project Number
J1409

Project Title
In Search of Pi

Abstract

Objectives/Goals
The objective to my project is to estimate pi by randomly dropping needles on a flat plane with parallel lines by using the probability that it crosses the line and find the needle length that gets that the quickest

Methods/Materials
MATERIALS
1 Pen
1 large piece of paper
1 Meter stick
40 flat toothpicks (referred to as needles)
Computer with Microsoft Excel
Procedures
1.Hand thrown needle experiment
A.Prepare the experiment
B.Conduct the experiment. For each of the 4 needle lengths, and for N=10 and N=100 drops
2.Computer simulation of random needle throws
A.Generate simulated random needle throw using Microsoft Excel
B.Determine how accurate the estimate of is for different needle lengths and different numbers of throws.

Results
I found that the needle that is the same length as the distance between the two lines has the most accurate estimate of pi.

Conclusions/Discussion
I concluded that throwing the needle with the same length as the space between lines gets the most accurate estimate of pi and the needle that is 1/4 of the distance between overestimate pi. When I was hand throwing the needles it was as random as I could get it but wasn#t truly random. When I was generating the experiment on the computer there was a equation mishap every once and awhile. When the equation generated a zero crossed the answer of pi is undefined because you cannot divide a number by zero. I took out this data set and replaced it.

Summary Statement
My project is dropping needles manually on a flat plane with parallel lines and by simulating this on the computer and using the probability of them crossing to estimate pi.

Help Received
My dad and my math teacher suggested I do a math science fair project.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Manjit Ruprem

Project Number

J1410

Project Title

Computer-based Automatic Music Creation through Analysis of Existing Music Pieces

Abstract

Objectives/Goals

The goal of this project is to create a program that can create new music through analysis of existing music using a computer. The objective of this project is to demonstrate the role of different parameters such as Note Sequence (NS), Note Sequence Repetition Density (NSRD), and the number of Measures (M)in the existing music. Music creation using computer algorithm has two approaches: (1) dedicated executable software that are designed to produce music, (2) the composition algorithm can be developed that creates new music. In this study, the composition algorithm is used to create new music. I made hypothesis that (I) as number of Note Sequence (NS) in input music increases, so does the number of NS in output; (II) As Note Sequence Repetition Density (NSRD) in input music increases, so does the NSRD in output.

Methods/Materials

The procedure is as follows. (i) Collect three music pieces and prepare respective description tables, (ii) Set up computer, software, and develop algorithm, (iii) Create three output music pieces for each piece of input music, (iv) Repeat for Music 2 and 3, and (v) Analyze data, make a graph, discuss, and conclude. The materials used in this project are as follows: Sheet Music of Music Pieces; Laptop with Windows XP; Spiral-bound Notebook; MATLAB Software; MC MusicEditor; and MIDI player.

Results

The data shows that the output Note Sequences (NS), as well as the Note

The data showed that the output NS and NSRD depended linearly on the input NS and NSRD, as long as the input is not changed. When the input was changed, the data showed no trends.

Conclusions/Discussion

It is observed that the sheet music has trends in Note Sequences (NS), Note Sequence Repetition Density (NSRD) and number of Measures (M) that characterize the music. The trends were explored with three music pieces. Any modification of the input will produce randomness in the created music and show no trend. All these factors (NS, NSRD, M) play an important role in creating new music via composition algorithm. This project can be extended to include variations of frequency and the shape of the note sequences in creating new music. This research study is the first of its kind to create thematic music pieces effectively in a computer-based environment. The outcome of this project has a wide range of usage: waiting-music during automated phone-calls, background music in airports, airplanes, and restaurants, and so on.

Summary Statement

This project developed a composition algorithm that creates new music pieces from the existing music utilizing appropriate procedures and methods.

Help Received

Brother helped learning programming; Mother helped holding the board while pasting the sheets on the board

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Dylan J. Sanfilippo

Project Number

J1411

Project Title

Deriving a Trigonometric Equation for Determining Object Height in Photographs

Abstract

Objectives/Goals

I received a camera for the holidays. I love film and photography. After examining some photography I came up with the idea of finding the height of an object in a photograph by developing a trigonometric equation, involving the focal length, to accomplish this. I believed that I would also need to know the distance from the camera to the object in order to find the height. I believed that if this equation was accurate, then perhaps it could be used in mapping land with a rover to help the authorities mathematically determine the height of land structures.

Methods/Materials

I used a DSLR camera, the Canon Rebel EOS t3i, to take the photographs. I used a metric ruler to determine how many meters the camera was placed from the object and to verify how many meters the object was in height. I marked the different lengths with tape. I took photographs of objects from various distances. Since tangent of the angle facing the right angle, equals leg1 divided by leg2. I calculated the angle of view using the arc-tangent vertical dimension of the sensor and the focal length. The equation I developed was calculated in radians. This was the formula I developed to determine heights of objects in a photograph.

"Distance[tan(height of object in printed photograph/height of photograph{2[arctan(vertical dimension of the camera's sensor/2*focal length)]})]=H"

Results

I found that my equation worked. I tested a total of 20 different photographs and each time I used the equation I found the height of the object. There was an average of 4.55 millimeters or 0.0455 meter difference when comparing the actual height to the calculated height, with a standard deviation of 0.031 meter difference. I believe this difference occurred because I wasn't precise enough in my measuring and taping.

Conclusions/Discussion

I created my own equation to find the height of an object in a photograph and my results appeared to support my hypothesis. If I were to continue this testing, I would be more careful with my measurements. This equation could be applied to a camera on a controlled robot to map out land and determine how tall mountains or boulders are on earth and even on mars.

Summary Statement

I created a trigonometric equation to find the heights of object in printed photographs.

Help Received

Mother took 2 photographs of me;

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Maya R. Sankar

Project Number
J1412

Project Title
Misspelled! Creating an Accurate Computerized Spell Correcting Algorithm

Abstract

Objectives/Goals
My goal is to create a spell-corrector using Python that corrects words with greater than 90% accuracy and that minimizes the time necessary to correct each word.

Methods/Materials
I will need a computer with the Python programming environment, a set of misspelled words, a corresponding list of the same words but correctly spelled, and a dictionary of correctly spelled words.
I will begin by creating an algorithm modeling the idea of addition-deletion-substitution, also known as edit distance or Levenshtein distance. I will also create an algorithm to test it, which returns a list of each misspelled word and its corrections. In addition, this algorithm will return how many words have each number of suggestions, how many words had one correct correction out of the total number of words, and the time the entire algorithm took to run. Based on this data, I will decide on possible improvements to the algorithm and retest it. This continues until I find the results of the algorithm satisfactory.

Results
The fifth algorithm I tested was the most accurate, and thus, the best. It was a combination of transposition (switching two consecutive letters), edit distance one (the one means that only one change can be made), and sound distance two (like substitution, except sounds are substituted for each other instead of letters. eg. brayd can become braid because ay and ai are both spellings of the long a). The algorithm didn't take too long, although it returned too many possible corrections for many words. This algorithm had about 90% accuracy and corrected about 321 words per second, both of which met the criteria and constraints.

Conclusions/Discussion
If this algorithm was made public, it could be used by small website owners. With enough online publicity, a large number of websites might benefit. In addition, my results were quite general, and this algorithm could be used to proofread any English text. This means that this algorithm could be used by any English program dealing with text, in schools, homes, or offices.
In doing this experiment, I learned to program with Python, and I began to understand a little about how we read English. For example, suffixes or silent 'e's will make a sound long, double consonants tend to make a vowel short, and w and y can change the vowels to other sounds as well. Through doing this project, I feel I learned a lot, from spell correction to programming and English.

Summary Statement
I am creating a computerized algorithm to correct spelling using Python.

Help Received
My father taught me programming and helped me debug.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Anurag Singh; Kaushik Tandon

Project Number

J1413

Project Title

Wi-Fi Watchdog: Application to Observe the Indoor Mobility of Senior Citizens

Abstract

Objectives/Goals

Our goal was to design a system that will remotely monitor the movements of a senior citizen between the rooms of their house without invading their privacy. Our Wi-Fi Watchdog application would run on a smart phone carried by the senior citizen and would use Wi-Fi signatures.

Methods/Materials

Wi-Fi Watchdog will demonstrate the ability to identify the current room in the house by matching its Wi-Fi signature against the Wi-Fi signature database of all the rooms in the house. The matching algorithm uses the Least Squares method for the prediction. For setup, we measured the Wi-Fi signatures in all the rooms of the house and stored the data in a signature database. For testing, we measured the Wi-Fi signature at a test location and identified the closest match from the signature database using the method of Least Squares. The closest match was the predicted room. We conducted our testing experiments in both a single-story and a double-story house. We used 10 tests per room in each house to show repeatable results. The test data is presented in a Confusion Matrix which shows the Predicted Room vs. the Actual Room We used Google Nexus 7 tablets as development and test devices; Eclipse IDE for Android Platform Development, BlueJ as an interactive Java Environment; and multiple standard wireless Access Points (AP's).

Results

Demonstrated 90% prediction accuracy using 3 Wi-Fi AP's in a double-story house with 6 rooms. Demonstrated 78% prediction accuracy using 5 AP's in a single-story house with 9 rooms. Showed that prediction accuracy can be increased by increasing the number of AP's. In the single-story house, with 3 AP's, we had a 53% accuracy rate. With 4 AP's, we had 66% to 71% accuracy in two separate experiments. With 5 AP's, we had an accuracy of 78%. Our project successfully solved challenges related to measurement noise in Wi-Fi data; variability in data due to direction of mobile device; and due to interference from undesired neighborhood AP's. Our system provides enhanced privacy, convenience and lower cost as compared to alternate designs such as video cameras or IR sensors.

Conclusions/Discussion

Our project successfully demonstrated a working prototype that can monitor the movements of a senior citizen between the rooms of their house without invading their privacy. With enhanced algorithms, this system can be used in retirement homes, hospitals and other scenarios where the indoor location of a person needs to be monitored.

Summary Statement

Wi-Fi Watchdog, an Android application, will remotely monitor the movements of a senior citizen between the rooms of their house without invading their privacy.

Help Received

Mrs. Thea Dalvand, science teacher at Kennedy Middle School, for being our sponsor teacher. Mr. Pankaj Tandon and Mr. Ajay Singh as project mentors. Mr. Prateek Tandon and Mr. Sameep Tandon for advice on Android and Java programming.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Raam Tambe

Project Number

J1414

Project Title

What If We Were Wrong? Security Algorithms' Sensitivity to Noise in Terms of Defender Expected Utility

Abstract

Objectives/Goals

In security games, defenders allocate resources then the attacker attacks as to maximize utility. However in a given security game, if the matrix changes and a target is worth more or less than previously predicted, a recipe for disaster is created. Applied to the real world, smugglers, poachers, terrorists etc., could make away with doing much more harm.

Methods/Materials

This project tests two algorithms DOBSS and Match in terms of robustness to noise, or their sensitivity to change, by testing them in four different matrices with various amounts of noise in the input and measuring the defender utility. If two programs DOBSS and Match were tested on their sensitivity to noise in the matrix, it was believed that Match would yield a higher utility than DOBSS.

Results

Contrary to the hypothesis, on average between all matrices, DOBSS yields a higher expected utility of 1.33462 points,than match yielding a utility of 0.1992 points, an average 1.13542 points higher. DOBSS therefore within the given setting is more robust to noise than match.

Conclusions/Discussion

Alone, the results are not sufficient enough alone to indicate whether or not DOBSS is more or less robust to noise than Match, further research and more tests are needed to provide an answer that would hold true in almost all scenarios. However this project provides massive steps towards future projects, and sheds needed light on the issue.

Summary Statement

This project tests security algorithms implemented across the nation on how well they would continue to protect us if the presumed values for targets the algorithms are defending changed.

Help Received

Dr.Milind Tambe, for teaching me the concepts that lead to this project being created; Andrea Acres, my science teacher, for helping correct papers, and giving the project direction; and Sonali Tambe, my mother for providing me with support when I was stressed.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Noah M. Toschi

Project Number
J1415

Project Title
Proof: The Area of the Arbelos

Abstract

Objectives/Goals
My objective was to prove that the area of the circle with diameter CD is equal to the area of the arbelos.

Methods/Materials
All I needed was a pencil, a couple pieces of paper, a straightedge ruler, and a compass (the one used for drawing circles). I then drew the diagram of the three semicircles with the two smaller ones inside the larger one and labeled the three points made by the semicircles A, B, and C. After that, I drew a point directly above point C and called it D; I also drew three line segments, from point A to point D, point B to point D, and point C to point D. Next, I drew a line tangent to the two smaller semicircles. Then, I used the points of tangency of the small semicircles, point C, and point D to draw a circle with diameter CD. Finally, I calculated the area of the circle and the area of the arbelos and compared them.

Results
After many computations, I found the area of the circle with diameter CD to be equal to the area of the arbelos.

Conclusions/Discussion
I learned from this experience that the arbelos can be used in structural drawing and architecture. If you draw two vertical lines that pass through the centers of the two smaller semicircles and through the entire diagram, you will make three sections of the diagram; then you can take out the middle section and put the remaining sections together, which would then form a pointed arch. This situation can only occur when the two smaller semicircles are the same size, because when the middle section is taken out and the two remaining sections come together, the halves of the two small semicircles would be symmetrical and form a perfect semicircle.

Summary Statement
My project is a proof on the area of the arbelos.

Help Received
My math teacher and my science teacher helped me find this topic.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Alexander Woodside

Project Number
J1416

Project Title
Sensors vs. No Sensors

Abstract

Objectives/Goals
My project was to determine if I do not use the light, ultrasonic, or touch sensors then my NXT Lego Mindstorms Robot will run just as consistent as a NXT Lego Mindstorms Robot, with the light, ultrasonic, or touch sensors, because I can create a reliable program for my robot to complete it's mission accurately every time.

Methods/Materials
First, I built a robot using a NXT Lego Mindstorms Education Kit. Second, I programmed the robot for a task using NXT-G Programming Software. Third, the mission must be completed 100 times without equipping a sensor. The mission must also be completed 100 times for each sensor (light, ultrasonic, and touch).

Results
The light sensor had 84 complete missions. The ultrasonic sensor had 93 complete missions. The touch sensor had 81 complete missions. The average complete mission for all sensors was 89. The amount of complete missions without using a sensor was 96.

Conclusions/Discussion
After 400 trials, I am happy to say sensors are not needed when completing a task featuring a NXT Lego Mindstorms Robot.

Summary Statement
To prove that sensors (ultrasonic, light, or touch) are not needed when trying to complete a task featuring a NXT Lego Mindstorms Robot.

Help Received
Thanks to Mountain Oaks for allowing me to use one of their NXT Lego Mindstorms Education Kits. Parents helped organize my board.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Sarah H. Kazmie

Project Number
J1497

Project Title
Danger, Will Robinson! Life Critical Computer User Interfaces and the Science of Safety

Abstract

Objectives/Goals
As technology plays a greater role in many aspects of critical safety, the fast response to computer generated emergency signals can save lives and prevent disasters. Many systems, including interfaces used in driving, navigation, flight, health care, surgery, security, defense, and public and industrial safety, could benefit from understanding how interface design, signal type and other conditions impact user reaction time to life critical messages and alerts.

Methods/Materials
I created a computer game to test and record users response times to a variety of interface configurations, warning methods and signal combinations. Rounds are randomly selected from 14 possible configurations to prevent the order of play from affecting the results. Players are distracted by steering a car to avoid oncoming traffic.

Results
In 65 games, played by subjects ranging in age from 7 - 72, more than 1,300 rounds were recorded and analyzed. The results of each round were stored in an Xml file, and graphed in Excel, after being analyzed and sorted in my own custom results reporting window.

Conclusions/Discussion
The use of audio signals or heads up displays significantly improves reaction time. Larger alert controls also produce faster responses. Listening to a voice at the time of the alert signal impairs reaction time, but hearing any spoken message, within a few seconds before the signal, can improve response. Music playing in the background can also improve response time.

Summary Statement
I wrote a game to test interface options and signaling conditions and find the configurations that will improve response in life critical computer/user interfaces.

Help Received
My teacher, Mrs. Bartley, explained the science fair and let me set up my computer in her classroom, My mom let me put my game in her store. My mom, my grandfather and our good friend Harry offered advice, suggestion and help printing my documents. Harry also taught me to use Visual C#.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Cade Pretorius

Project Number

J1498

Project Title

Programmatic Signature Fraud Detection

Abstract

Objectives/Goals

The reason I did my experiment was to determine if a computer program can prevent signature fraud. In a grocery store, for example, you often have to sign when a credit card is used. Using this program, someone can sign, and the signature can be compared to a database which holds their previous signature, thus preventing another person from stealing their money.

Methods/Materials

Method: 1. Reset all variables. 2. Sign to capture first signature position and interval data points. 3. Save signature to file. 4. Return to program. 5. Click "Second Signature" button. 6. Sign to capture second signature position and interval data points. 7. Perform Steps 3-4 again. 8. Click "Result" button. 9. The program copies, saves, and aligns starting point and other X-Y coordinates. 10. Record results. 11. Repeat Steps 1-10 for each trail.

Materials: HP G60-441US Notebook PC; Samsung tablet/computer to sign on; A computer program written in JavaScript and HTML5; Stylus to sign with

Results

When the same person signed, the percentage similarity was approximately 95%. With different people signing, the similarity was always below 90% and going as low as -91,528,438,830,282.2%.

Conclusions/Discussion

The results from my experiment prove my hypothesis. The computer program was able to distinguish between people signing. The program that I wrote met all of the design specifications I had in mind.

Summary Statement

My Science Project tests whether a computer program can differentiate between two signatures and detect the same signatures.

Help Received

I would like to acknowledge my Dad for helping me through some of the bumps I had with programming. My Mom gave input as to the organization of my display board.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Christian Inglehart

Project Number

J1499

Project Title

The Monty Hall Problem

Abstract

Objectives/Goals

The purpose of this statistical math model is to prove or disprove whether choices in the classic Monty Hall Problem game are statistically the 33.3% -don#t switch doors win / 66.6%- switch door win prediction in one school of thought or the 50%/50% choice-no choice prediction some claim to make.

Methods/Materials

Basically what I did was to create an experimental model to examine the results of these choices. Rows of plastic cups were set up to simulate the doors of the game with a Hotwheel car under one of three cups. A choice was made in each trial and an objective host removed a known #door# with no car prize. In one trial I stayed with the original choice and recorded a win or loss. In the other trial, I was offered a choice to switch and always made a switch to the other offered door, and again recorded results.

Results

My results in the first trial of not making a switch to the offered door indicated results near the predicted 33.3% / 66.6% of 35% / 65%. However, in the second trial of always making the switch to the other offered simulated door, my results exceeded the predicted results of 33.3% / 66.6% with 20% / 80% losses and wins respectively.

Conclusions/Discussion

My conclusions are that switching doors does indeed make a significant statistical difference in wins and losses in the Monty Hall Problem. I have also concluded that though one experimental trial was very close to the predicted results, the other trial (though proving successful experimentally) may require more points of data in the trial run to statistically produce results closer to the predicted results.

Summary Statement

This math project statistically examines "door selection" in the classic "Let's Make a Deal" game program.

Help Received