Advancement of a Lie Detector Algorithm

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Introduction

- The purpose was to create a reliable algorithm or logical method to discern whether deception was occurring
- Problems include effectively analyzing given data while evaluating potential improvements and analyzing cost
- Lie detectors cannot explicitly detect deception. Instead, they test for "deceptive actions". ("What Is A Polygraph")
- Polygraph tests have an average accuracy rate of 70% (Vogel)
- Daniel Langleben found that the brain was more active when lying since truth telling was the default modality (Ganis et al.)
- Common alternatives include MRI, fMRI, PET scans, and Certified Voice Stress Analysis. (National Research Council 158)

Methodology

Lie Detector Algorithm

- Microsoft Excel was used for analysis
- Averages were calculated for each question and the percent difference formula was used to compare questions to the control question.
- If the sum of the percent differences was greater than the percent difference of the period while the subject was not being questioned, it was considered a lie (See Figure 1)

Improvement

- A decision matrix was used to determine which sensors were removed or added.
- Sensors for blood pressure and temperature were further analyzed

Cost Analysis

- The cost was calculated by factoring out unused sensors from a found standard lie detector cost, factoring in the technician fee, and also factoring in the cost of any additional sensors
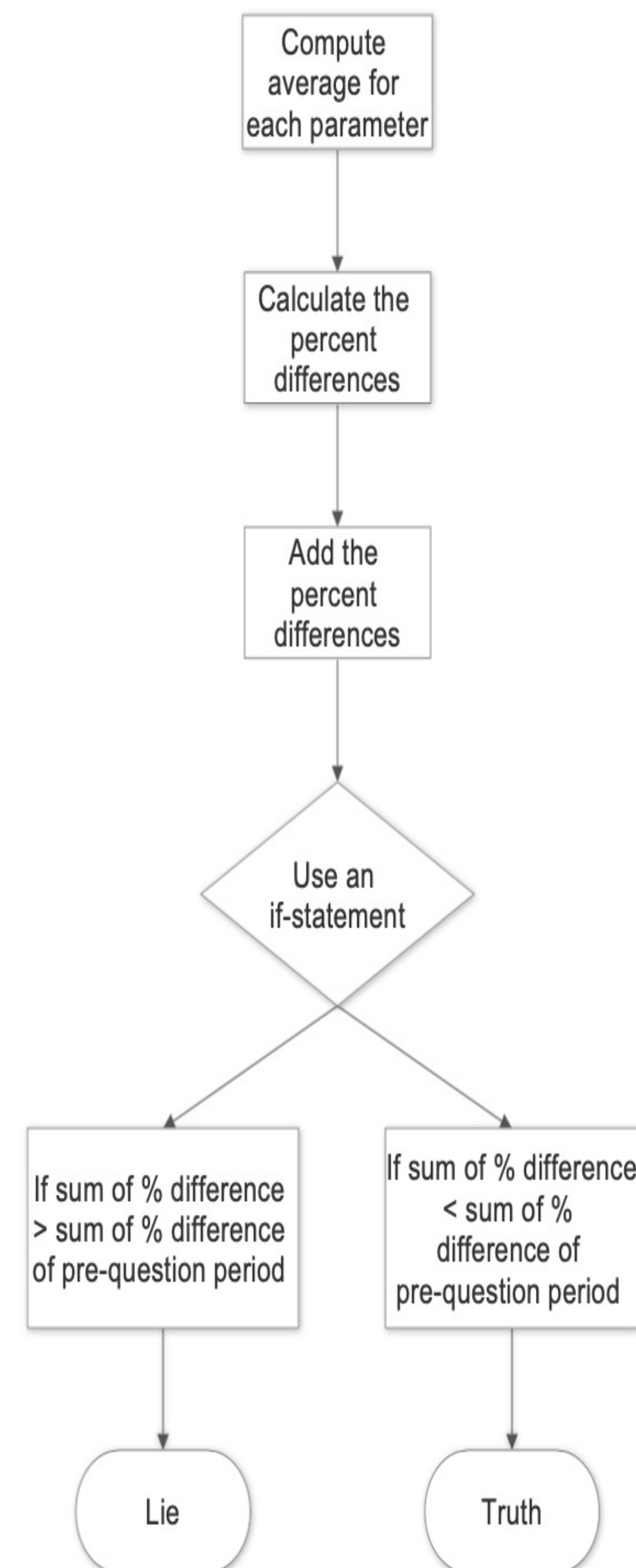
Results and Figures

Figure 1. Summarized Lie Detector Algorithm

Initial Algorithm Results

- Questions 1, 4, 5, 7, 9, and 10 were concluded as lies
- Had an 80% accuracy

Improved Algorithm Results

- Temperature sensor and blood pressure cuff were added with the movement sensor removed.
- Questions 1, 5, 7, 9, and 10 were concluded as lies
- Had a 90% accuracy

Cost Analysis

- After improvements the cost was calculated to be $999
- With the technician fee of $100 per hour for 2 hours, the total cost was $1,199
- 20% lower cost than the base model

Table 1. Results of the Initial and Improved Lie Detectors

Question	Initial Result	Improved Result
1	Lie	Lie
2	Truth	Truth
3	Truth	Truth
4	Lie	Truth
5	Lie	Lie
6	Truth	Truth
7	Lie	Lie
8	Truth	Truth
9	Lie	Lie
10	Lie	Lie

Discussion

Lie Detector Algorithm

- The algorithm was easy to use and gave a reliable way to analyze for deception
- While the accuracy was not perfect, it was as accurate as a standard polygraph test.

Sensor Improvements

- The movement sensor was a voluntary physiological response, and getting rid of this improved the algorithm. Adding blood pressure and temperature sensors increased the accuracy significantly.
- The improved sensor had a 10% accuracy increase (See Table 1)

Cost Analysis

- The cost of the improved model was 20% less than the cost of the initial lie detector

Conclusion

- An algorithm was created using average and percent difference to determine if deception occurred with a 80% accuracy
- With these results, an improved lie detector was created that had a 90% accuracy
- Futures work would include minimizing the effect of external factors
- Conducting anxiety-relieving activities before the polygraph test and establishing an accurate baseline should be tested

References

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