

Detailed Analyses of Different Types of CAPTCHA

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ABSTRACT

Captcha is a very simple technique to solve the problem of Turing test .It comes in a lot of forms from simple text Captcha to today's Mouse Captcha. Captcha is not only restricted to use for email registration but also used in filing income tax returns, banking transactions, ticket booking, insurance payments etc. Each web site that requires some kind of input requires a Captcha. In this paper we have discussed various types of Captchas.

Keyword: Captcha, Turing, Bots.

1. INTRODUCTION

The acronym of CAPTCHA *Completely Automated Public Turing Test to Tell Computers and Human Apart*. The word *Public* in the acronym tells that the code and data used by a CAPTCHA should be publicly available [1]. CAPTCHA was introduced by John LAnford of Carnegies Mellon University [2] but the basic work was done by Mori Naor who first time described the concept of Turing test to identify the difference between a human and BOT in 1996 [3]. In computer dictionary such tests are called Captcha. So CAPTCHA are Human Interactive Proofs (HIPs), a challenge meant to be easily solved by computers but too difficult to be solved by current computer system.

1) Uses of Captcha.

- 1.1) Rejection of fake email registration [1][7].
- 1.2) Minimize Phishing Attacks [14][15][16].
- 1.3) Identifying fake email address [1].
- 1.4) Rejecting bots Playing Online Games [8][9][10].
- 1.5) Stopping Automatic Online Polls- [1][7]
- 1.6) Stopping Dictionary Attacks [11] [12][13].

2) Types of Captcha

After discussing a number of applications of Captcha it is the time to know the types of Captcha. A Captcha can be of the following types:

- 2.1) Text Captcha
- 2.2) Image Captcha
- 2.3) Audio Captcha
- 2.4) Video Captcha

2.5) Puzzle Captcha

2.6) Mouse Captcha

2.1) Text Captcha- These are the very basic type of Captcha. These are the most used Captchas. The user is presented a string of characters that are easy to recognize but not easy for a computer. The strings can vary from a clear text to very noisy. A distorted text Captcha is shown in Fig. 1. Fig. 2 shows a noisy Captcha.



Figure 1 Distorted Captcha



Figure 2 Noisy Text Captcha

Another kind of text Captcha is Baffle Text[17] developed by Monica Chew and Henry Baird.

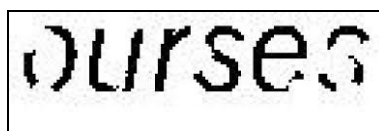


Figure 3 (Baffle Text Captcha)

SS-Captcha or (Strangeness in Sentences)is proposed by Yamamoto, Tygar & Nishigaki[40].This Captha is based on the ability of human of distinguishing natural and machine translated sentences. [40].

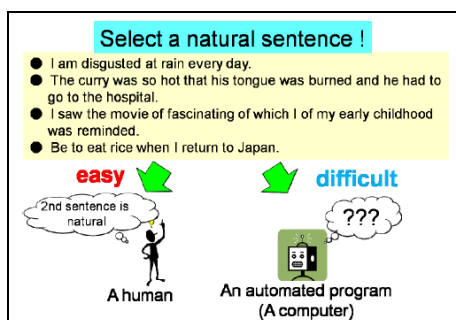


Figure 4 SS-Captcha

There is another kind of Captcha known as Pessimist Print Captcha. This Captcha uses a document image degradation that is ten aspect of physical of machine printing and images of text [17].



Figure 5 Pessimist Captcha

Text Captcha can be very noisy and too much distorted. Such text Captchas are hard to break other by the computers as well as by the human beings. [18].

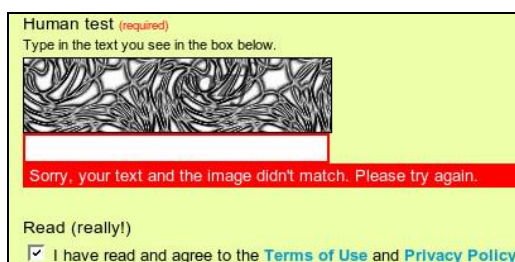


Figure 6 Text Captcha with extra noise

2.2) Image Captcha- After text base Captcha we discuss image based Captcha. Here the images do not contain only simple text information but real object pictures etc. Computer programs are not as good as human in identifying graphics. Some of the image based Captchas are described below [19]:

2.2.1) Four Panel Cartoon Captcha- This Captcha is very easy for human but not too easy for computers .It is based on the ability to understand humor [20]. The user is presented a four panel filled with images, and asked to arrange them in order



Figure 7 (Four Panel Captcha)

2.2.2) Drag n Drop Captcha- Next is Drag n Drop Captcha in which the user is presented with a dialog box that instruct the user to drag an GUI element to another location[32][33].

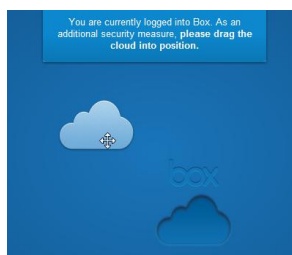


Figure 8 (Drag n Drop Captcha)

2.2.3) Collage Captcha- This technique was proposed by M. Shirali-Shehreza and S. Shirali-Shahreza[22]. Here the user is asked to select a picture with a given criteria e.g. select a picture that is of a car etc.

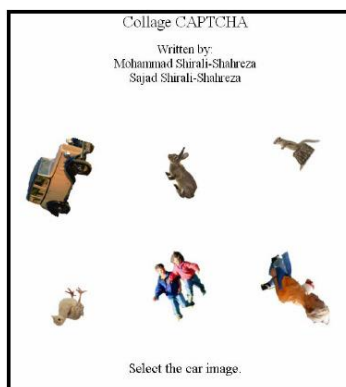


Figure 9 Collage Captcha

2.2.4) Drawing Captcha- This Captcha is GUI based where user is asked to join the asked dots with using touch panel of the device. [21].

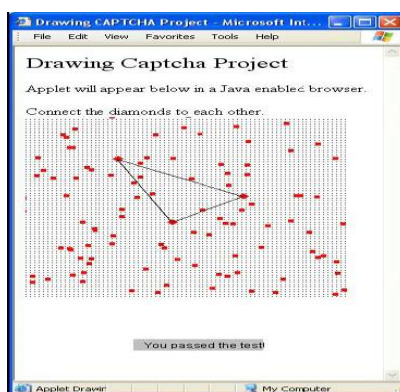


Figure 10 Drawing Captcha

2.2.5) Assira Captcha – This is also a picture based Captcha .Assira stands for Animal Species Image Recognition for Restricting Access . It is based on the cat/dog labels. This Captcha randomly picks the images from petfinder.com and ask the user to select all cat or dog mages etc[41].



Figure 11 Assira Captcha

2.3) Audio Captcha- After looking at text and image Captchas now we see third type of Captcha. In audio Captcha a sound is played with additive noise. Sometime the audio is played without any noise as well .After listen the audio the user has to type or press the key for the played word or character. This Captcha can also be very useful for visually impaired users [17][21].

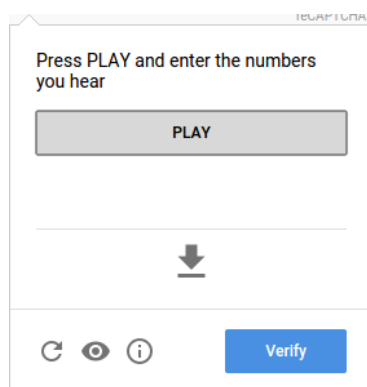


Figure 12 Text-To-Speech Conversion Audio Captcha

2.4) Video Captcha- This is a new kind of Captcha. A video Captcha may ask the user to describe any three words about the shown video [28]. The user can also be asked to type the characters of particular color etc. Such Captcha is developed by Nuaptcha.com as shown in the Fig.[29][30]:



Figure 13 (Video Captcha from Nuaptcha.com)

2.5) Puzzle Captcha- Humans are very intelligent to solve puzzles but a computer finds it very difficult to solve puzzle especially image based puzzle. So puzzle based Captchas are recommended for internet security. Puzzle Captcha are based on question that can be simple or difficult. A lot of versions are available in this form.

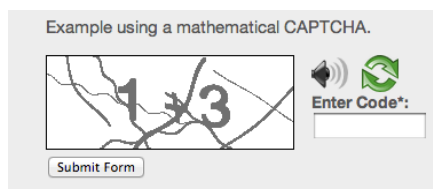


Figure 14 (Mathematical Captcha)

2.5.6) Jigsaw Puzzle Captcha- this Captcha is based on jigsaw puzzle. Here the user is presented with a game of images divided into pieces. This type of Captcha is language independent and very easy to solve by human [35].

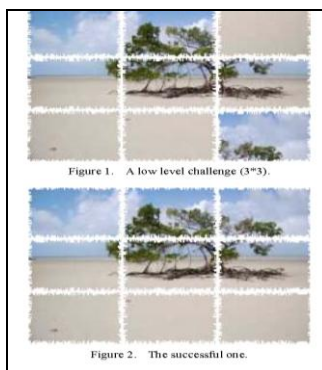


Figure 15 (Jigsaw Puzzle Captcha)

2.5.7) Multiple SEIMCHA -Mehrnejad, Bafghi, Harati & Toreini designed a similar Captcha based on the image orientation and geometric transformations [25]. A set of 3D images are prepared by transformation and warping of an image in cylinder and hour glass etc. then projection(2-D) is applied on images and user is asked to click on the upright orientation of the final image.

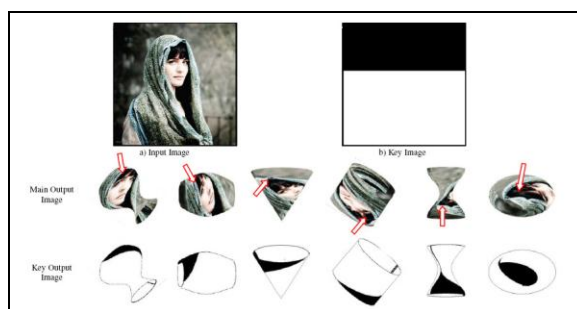


Figure 16(Multiple SEIMCHA)

2.6) Mouse Captcha- ReCaptcha is the latest Captcha designed by Google that is free from any text , image or puzzle .The user is needed to click of the mouse and the computer will identify whether there is a human on program on the other side.

II.CONCLUSION

This paper is beneficial for the analyses of the various types of Captchas available. After analyzing these Captchas one can design a new Captcha and also improve the existing Captchas. I have not discussed the limitations and strengths of all Captchas but the information provided in this paper can be very important for a new reader that wants to know about Captchas. I have discussed the old text style Captchas to very modern Mouse Captcha so it can be worth reading material for Captcha designers.

REFERENCES

- [1] Von Ahn, L., Blum, M. and Langford, J., 2004. Telling humans and computers apart automatically. *Communications of the ACM*, 47(2), pp.56-60.
- [2] L Ahn, M. Blum and J. Langford. Telling Humans and Computers Apart Automatically. *Communications of the ACM*, 47(2):57-60, 2004.
- [3] Moni Noar. "Verification of a human in the loop, or Identification via the Turing test", taken from wisdom.weizmann.ac.il, Available at <http://www.wisdom.weizmann.ac.il/~nor/PAPERS/human.ps>.
- [4] A.L. Coates, H.S. Baird, and R. J. Fateman, Pessimal Print: A Reverse Turing Test, Proc., ICDAR 2001 International Conference on Document Analysis and Recognition, Seattle, WA.
- [5] Alan M. Turing. Computing Machinery and Intelligence. In: *Mind*, vol 59, No. 236, pp. 433-460, 1950.
- [6] Pope, C. & Kaur, K. (2005), "Is it human or computer? Defending e-commerce with Captchas", *IT Professional*, vol. 7, no. 2, pp. 43-49.
- [7] Pope, C. & Kaur, K. (2005), "Is it human or computer? Defending e-commerce with Captchas", *IT Professional*, vol. 7, no. 2, pp. 43-49.
- [8] Roman V. Yampolskiy, Venu Govindaraju. Embedded noninteractive continuous bot detection. *Computers in Entertainment (CIE)*, vol. 5 Issue 4. March 2008. (ACM).
- [9] P. Golle and N. Ducheneaut. Preventing bots from playing online games. *Comput. Entertain.*, 3(3):3, 2005.
- [10] Hilaire, S.; Hyun-chul Kim; Chong-kwon Kim; How to deal with bot scum in MMORPGs?; IEEE International Workshop Technical Committee on Communications Quality and Reliability (CQR), 2010. Pp: 1 – 6.
- [11] Dictionary Attack, available at http://en.wikipedia.org/wiki/Dictionary_attack.
- [12] S. Chakrabarti and M. Singhal. Password-based authentication: Preventing dictionary attacks. *Computer*, 40(6): pp. 68-74, June 2007.
- [13] B. Pinkas and T. Sander. Securing passwords against dictionary attacks. Proc. of 9th Conf. on Computer and Communications Security, pp. 161-170, Nov. 2002.
- [14] B. Pinkas and T. Sander. Securing passwords against dictionary attacks. Proc. of 9th Conf. on Computer and Communications Security, pp. 161-170, Nov. 2002.
- [15] Phishing Attack, <http://en.wikipedia.org/wiki/Phishing>.

- [16] Dynamic , Mutual Authnetication Technology for Anti Phishing. Confidenttechnologies.com, Retrieved September 9, 2012.
- [17] Chen Li, W.A., Wang, J. & Liu (2010), "Protection Through Multimedia CAPTCHAS", vol., no.pp.
- [18] Imsamai, M. & Phimoltares, S. (2010), "3D CAPTCHA: A Next Generation of the CAPTCHA ", Information Science and Applications (ICISA), 2010 International Conference on, Seoul, 2010, vol., no. pp. 1 – 8.
- [19] Singh Ved. & Pal preet. (2014), "Survey of different Types of CAPTCHA", international Journal of computer science and information technologies, 2014 vol.5, no. 2 pp. 2242-2245.
- [20] Yamamoto, T., Suzuki, T. & Nishigaki, M. (2011), "A Proposal of Four-Panel Cartoon CAPTCHA: The concept", Advanced Information Networking and Applications (AINA), 2011 IEEE International Conference on, Biopolis, 2011, vol., no. pp. 159-166.
- [21] Shirali-shahreza, M. (2008), "Dynamic CAPTCHA ", Communications and Information Technologies, 2008. ISCIT 2008. International Symposium on. Lao.2008, vol., no. pp. 436-440
- [22] Shirali-shahreza, M. & Shirali-shahreza, S. (2007), "Collage CAPTCHA", Signal Processing and Its Applications, 2007. ISSPA 2007. 9th International Symposium on.Sharjah.2007, vol., no. pp. 1-4.
- [23] Shirali-shahreza, M. & Shirali-shahreza, S. (2008), "Advanced Collage CAPTCHA", Information Technology: New Generations, 2008. ITNG 2008. Fifth International Conference on, Las Vegas, NV, 2008, vol., no. pp. 1234-1235.
- [24] Shirali-shahreza, M. & Shirali-shahreza, S. (2007), "Online Collage CAPTCHA", Image Analysis for Multimedia Interactive Services, 2007. WIAMIS '07. Eighth International Workshop on.Santorini, vol., no. pp. 58-58.
- [25] Mehrnejad, M., Bafghi, A.G. Harati, A. &Toreini, E (2011), "Multiple SEIMCHA: Multiple semantic image CAPTCHA", Internet Technology and Secured Transactions (ICITST), 2011 International Conference on, Abu Dhabi, vol., no. pp. 196-201.
- [26] Shirali-shahreza, S. & Shirali-shahreza, M. (2008), "CAPTCHA for children",System of Systems Engineering, 2008. SoSE '08. IEEE International Conference on, Singapore, 2008, vol., no. pp. 1-6.
- [27] Shirali-shahreza, S., Abolhassani, H., Sameti, H. & Shirali-shahreza, H. (2009), "Spoken CAPTCHA: A CAPTCHA system for blind users", Computing, Communication, Control, and Management, 2009. CCCM 2009. ISECS International Colloquium on, Sanya, 2009, vol. 1, no. pp.221-224.
- [28] Kluever, K.A. and Zanibbi, R., 2009, July. Balancing usability and security in a video CAPTCHA. In Proceedings of the 5th Symposium on Usable Privacy and Security (p. 14). ACM.
- [29] NuCaptcha. Whitepaper: NuCaptcha & Traditional Captcha,2011. <http://nucaptcha.com>.
- [30] Xu, Y., Reynaga, G., Chiasson, S., Frahm, J.M., Monroe, F. and Van Oorschot, P., 2012. Security and usability challenges of moving-object CAPTCHAs: decoding codewords in motion. InPresented as part of the 21st USENIX Security Symposium (USENIX Security 12) (pp. 49-64).
- [31] Shirali-shahreza, M. & Shirali-shahreza, S. (2008), "Motion CAPTCHA", Human System Interactions, 2008 Conference on, Krakow, 2008, vol., no. pp. 142-1044.

- [32] <https://www.letsnurture.com/blog/8-widely-used-captcha-examples.html>
- [33] <https://www.quora.com/What-are-the-types-of-CAPTCHA>
- [34] M. Shirali-Shahreza and S. Shirali-Shahreza, "Question-Based CAPTCHA," Proceedings of the International Conference on Computational Intelligence and Multimedia Applications (ICCIMA 2007), Sivakasi, India, December 13-15, 2007, Vol. 4, pp. 54-58.
- [35] Gao, H., Dan, Y. Liu, H. Liu, X. & Wang, L (2010), "A Novel Image Based CAPTCHA Using Jigsaw Puzzle", Computational Science and Engineering (CSE), 2010 IEEE 13th International Conference on, Hong Kong, 2010, vol., no. pp. 351-356.
- [36] Almazyad, A.S., Ahmad, Y. & Kouchay, S.A. (2011), "Multi-Modal CAPTCHA: A User Verification Scheme", Information Science and Applications (ICISA), 2011 International Conference on, Jeju Island, 2011., vol., no. pp. 1-7.
- [37] Steven A. Ross, J. Alex Halderman, Adam Finkelstein "Sketcha: A Captcha Based on Line Drawings of 3D Models", WWW 2010, April 26-30, 2010, Raleigh, North Carolina, USA. ACM 978-1-60558-799-8/10/04.
- [38] Chellapilla, K., Larson, K., Simard, P. and Czerwinski, M., 2005, April. Designing human friendly human interaction proofs (HIPs). In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 711-720). ACM.
- [39] Chow, R., Golle, P. Jakobsson, M., Wang .L. & Wang , X. (2008), "Making CAPTCHAs clickable ", Conference HotMobile '08 Proceedings of the 9th workshop on Mobile computing systems and applications on. New York. 2008, vol., no. pp.
- [40] Yamamoto, T., Tygar, J.D. & Nishigaki M. (2010), "CAPTCHA Using Strangeness in Machine Translation", Advanced Information Networking and Applications (AINA), 2010 24th IEEE International Conference on, Perth, WA, 2010, vol., no. pp. 430-437.
- [41] Captcha the dog, available at, <http://www.captchathedog.com>.
- [42] identiPic CAPTCHA, available at , <http://www.identipic.com>.
- [43] "How does google no capthca recapthca work" available at www.qnimate.com
- [44] "Choosing the type of reCaptcha" available at <https://developers.google.com/recaptcha/docs/versions>