世界の幸せをカタチにする。
Creating Peace & Happiness for the World

Musashino University

Conversational Bot for Eyesight Testing Automation

Ari Yanase[1], Virach Sornlertlamvanich[1,2], Thatsanee Charoenporn[2]

[1]Asia AI Institute, Faculty of Data Science, Musashino University, Japan

[2]SIIT, Thammasat University, Thailand

s1922073@stu.musashino-u.ac.jp,{virach, thatsane}@musashino-u.ac.jp

ABSTRACT

The people's visual acuity can be examined using a standard Snellen eye chart by determining a relationship between the sizes of certain letters viewed at certain distances, or a broken wheel vision chart. In general, we examine our eyesight by reading the letter "A" with 88 mm in height at 20 feet or 6 meters in distance. To lessen the burden of the ophthalmologist, we equip an NLP based chatbot with basic eyesight testing knowledge in a mobile app. With the natural conversation, the bot recognizes the response from the subject, and returns the prescriptions for eyeglasses measured in diopters.

人々の視力測定は、(ある一定の距離から特定の文字サイズの関連性を決定する)スネレン指標や壊れた車輪モデルの図などを用いて検査することができる。一般的には、6メートルもしくは20フィート離れた距離から、高さ88ミリで書かれた文字"A"が読むことによって私たちは自分自身の視力を測ります。本研究では、私たちは携帯アプリの中に視力検査の知識を持った自然言語処理技術ベースのチャットボットを配備することによって、眼科医の負担を減らしました。自然な対話によって、このボットは被験者からの答えを認識し、眼鏡の焦点距離を予測します。

MOTIVATION

It is always a long queue of patients coming to have their eyesight screening before being appointed to see the doctors. The primary eyesight testing is a relatively simple task but need a space for reading a vision chart with a clinician assistant support.

Photo courtesy of Banphaeo General Hospital

To measure the visual acuity, as today's examine lanes often are smaller than 20 feet (6 meters), charts are often designed for shorter distances. Applying the Louise Sloan defined Snellen's M-unit as the size that subtends 5 min of arc at 1 meter as "this letter is 'x' M-units", we determine the visual acuity by the following equation. The number denoting the M unit size is the viewing distance in meters for 20/20 acuity, as shown in Figure 1.

$$Visual\ acuity = \frac{Test\ distance}{Letter\ size}$$

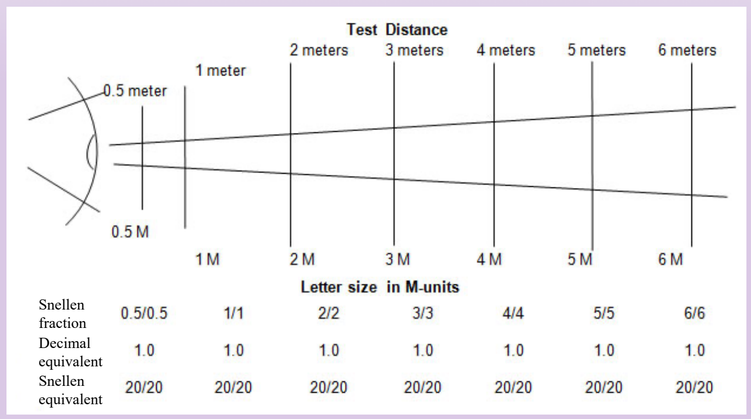
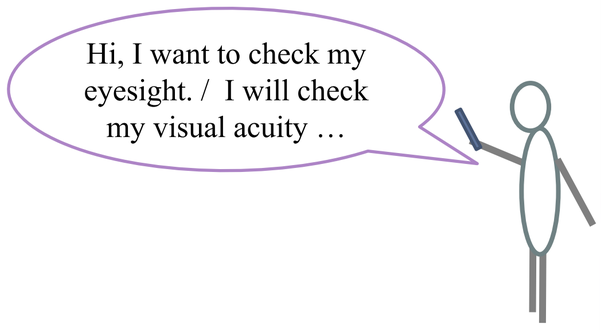


Figure 1. letter size designation in M-units

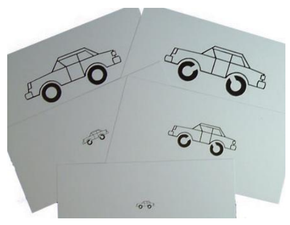
In fact, there are several apps to measure visual acuity, but most of them need enough space for installation, multiple devices, and so on. The conversational bot we introduce in this research needs only a device, such as a smartphone, you are using in everyday life. Our proposal overcome the difficulty and allow each patient to make conversation with the bot to measure the visual acuity for the primary screening.

EYESIGHT TESTING WITH CONVERSATIONAL BOT

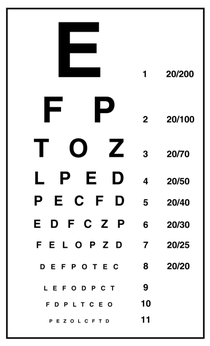
① Call the bot to start



② Select the chart type

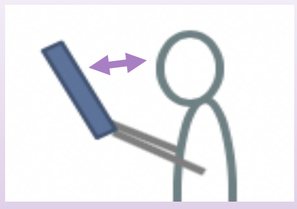


Broken wheel vision chart

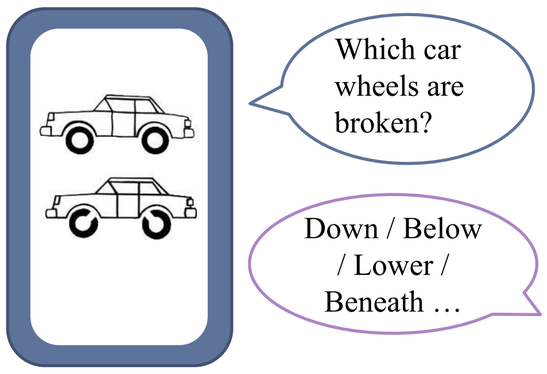


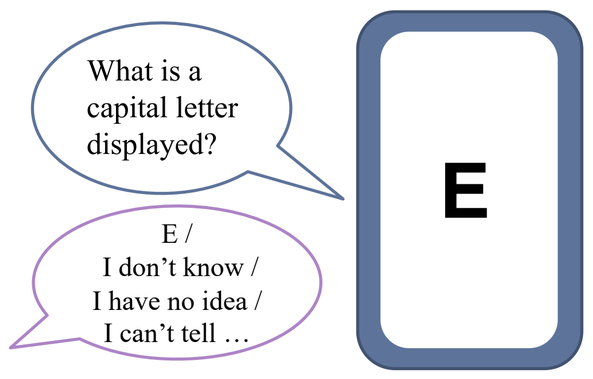
Standard Snellen eye chart

③ Hold your smartphone with your screen 16 inches away

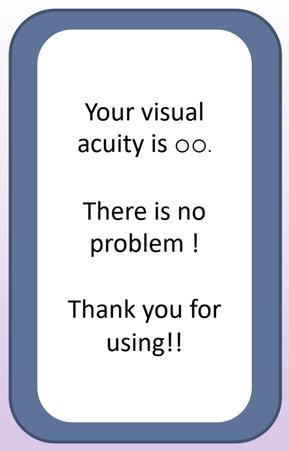


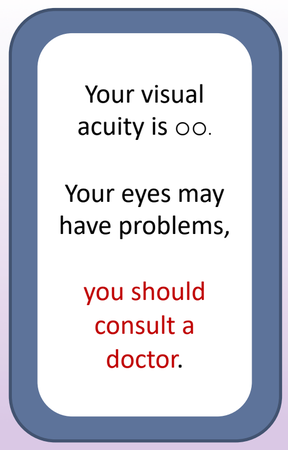
③ Start examination





④ Repeat step ③ and get the result

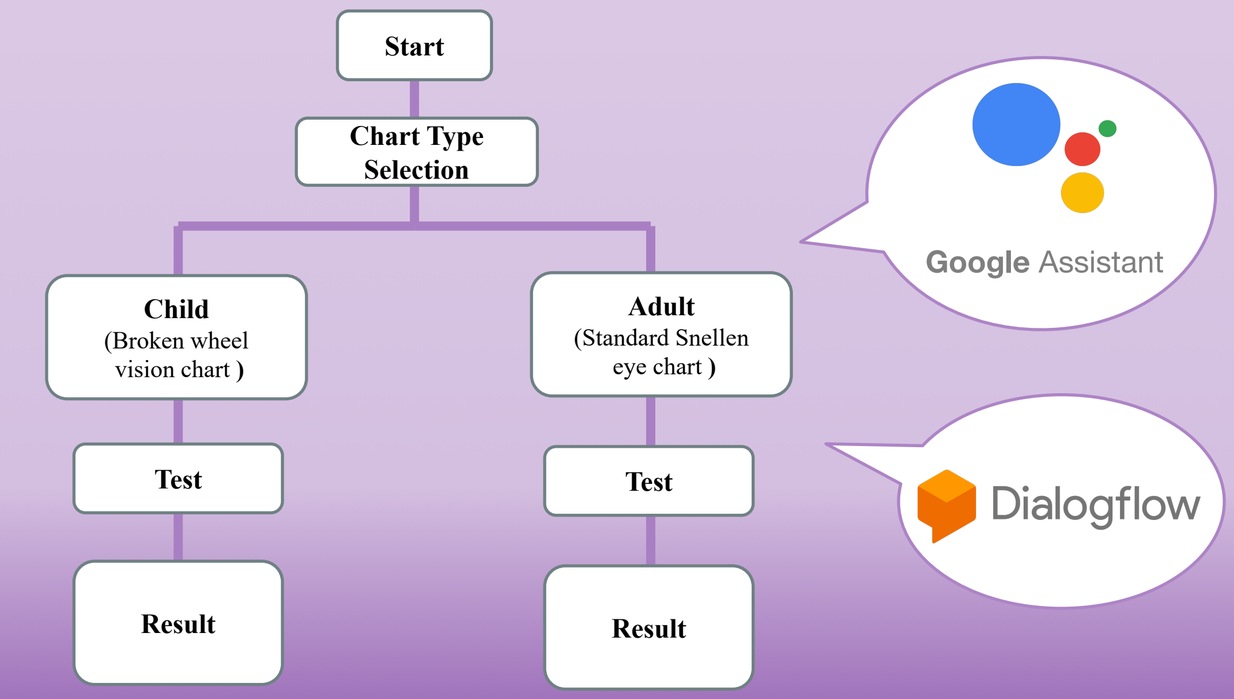




SUMMARY AND CONCLUSION

A simple conversational bot for eyesight testing automation has been realized on the Snellen designed chart by combining the Chatbot ability provided by DialogFlow with Google Assistant to support the natural conversation. The proposed method still has a limitation in its near acuity measurement, which may cause the eye stress during measurement. However, in the step of eyesight screening, it is efficiently implemented to lessen the burden of the ophthalmologist and to relieve the patients from the long waiting line in the hospital. Occasionally, the patient is also allowed to examine the change of eyesight in the progression of eye disease or during the process of eye healing. With the popularly use of smart phone at present, the mobile app can be expected to be an effective tool when equipped with the advancement of human language technology. The system can also be feasibly extended to support multiple language conversation based on the same examination criteria.

CONVERSATION FLOW DESIGN



ACKNOWLEDGEMENT

We would like to express our gratitude to Banphaeo General Hospital for their valuable comments in practice.

REFERENCES

1. Pavindran A Counder, Eliza Cole, Stephen Colley, David M Hille. (2014).Validation of a Portable Electonic Visual Acuity System. Journal of Mobile Technology in Medicine
2. Steve Colley, S. (2013). Eye Apps. Retrieved from http://eyeapps.com.au
3. Schneider, J. (May 2002). Classic Eye Chart. Retrieved from http://www.i-see.org/eyecharts.html
4. Segre, L. (June 2019). What's an eye test? Eye charts and visual acuity explained. Retrieved from https://www.allaboutvision.com/eye-test/
5. Watt, W.S. (October 2019). How Visual Acuity Is Measured. Retrieved from https://lowvision.preventblindness.org/2003/10/06/how-visual-acuity-is-measured/
6. Precision Vision. (November 2019). Snellen Eye Test Charts Interpretation. Retrieved from https://www.precision-vision.com/snellen-eye-test-charts-interpretation/