



## A method for searching photos on a mobile phone by using the fisheye view technique

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### ABSTRACT

This study evaluates the use of fisheye view to help search for photos in the thumbnail preview on mobile phones with 2 inch diagonal and 3 inch diagonal screens. The factors varied were the number of thumbnails on a screen (array size) and the delay time between selecting the original thumbnail preview and converting it to a fisheye view. On a 2 inch diagonal screen, both user preference and search performance were better on a  $3 \times 3$  array and  $4 \times 4$  array than on a  $5 \times 5$  array. On a 3 inch diagonal screen,  $4 \times 3$  and  $5 \times 4$  arrays were preferred over a  $6 \times 5$  array, but search performance was not statistically different among the arrays. The fisheye view increased search accuracy and speed in  $4 \times 4$  and  $5 \times 5$  arrays on the 2 inch screen, but not in a  $3 \times 3$  array on a 2 inch screen or in any array on a 3 inch screen. Delay time did not affect performance or preference on a 2 inch screen. It is recommended that 16 (a  $4 \times 4$  array) or fewer images should be displayed on a 2 inch screen, and 20 (a  $5 \times 4$  array) or fewer on a 3 inch screen. The delay time should be 0.6 s–1.0 s when using a  $4 \times 4$  array on a 2 inch screen. These results can also be applied to other mobile personal devices with small screens such as digital cameras and PDAs.

*Relevance to industry:* The results suggest an effective way of presenting multiple images on a small screen. Also, evaluation method used in this study can be applied in other small display devices as well.

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### 1. Introduction

Camera functions on mobile phones are very popular. World-wide, 89% of cell phones sold include a camera function (Info Trends, 2009). Nowadays, camera functionality became a standard feature on mobile phones. As the image quality of the photo became an important differentiator, camera phones with high megapixels will gradually increase in mobile phone market (Gartner, 2009). As users carry their mobile phone most of the time, they have many chances to take and store photos on a mobile phone. The number of photos that can be stored on a mobile phone is increasing. Thus, searching for photos can be difficult, especially on a small screen. An efficient and effective method to improve the usability of searching tasks is necessary.

Two methods are generally used for searching images such as a text based search (Drucker et al., 2004; Kang and Shneiderman, 2000; Kuchinsky et al., 1999; Lee et al., 2006; Wilhelm et al., 2004) and an image based search using an image list (Barrett, 2002; Bederson, 2001). When using a text based search, keywords

or meta-information (such as date, or a file type of the image) related to a target photo is used. However, most users do not create an annotation or a title with meta-information because it takes time and somewhat difficult to remember (Rodden, 2002).

To reduce this difficulty the image based searching method, especially with thumbnails is suggested as an alternative. As humans can process visual information of thumbnail preview better than text (Patel et al., 2006), thumbnail preview has wide application areas in many forms (Combs and Bederson, 1999). Aigrain and Longueville (1992) evaluated navigational links between images to help image search task by presenting the most relevant images within a current context. Bjork and Redstrom (1999) suggested a thumbnail based searching method called 'Flip zooming' with which an image is enlarged when the image was selected. Similarly, methods using the size of the image such as 'Auto zoom' and 'Gesture zoom' were developed for mobile devices (Patel et al., 2006). Other researchers suggested image presenting methods using zoomable user interface (ZUI) for a limited screen size such as pan/zoom, miniature map, and distorted view (Dill et al., 1994; Harrie et al., 2002). These methods, however, have several drawbacks. Users can suffer from a 'keyhole problem' since pan/zoom cannot present the whole image when the size of the photo exceeds the size of display (Dill et al., 1994). Problems of

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