Adaptive Manga Re-Layout On Mobile Device

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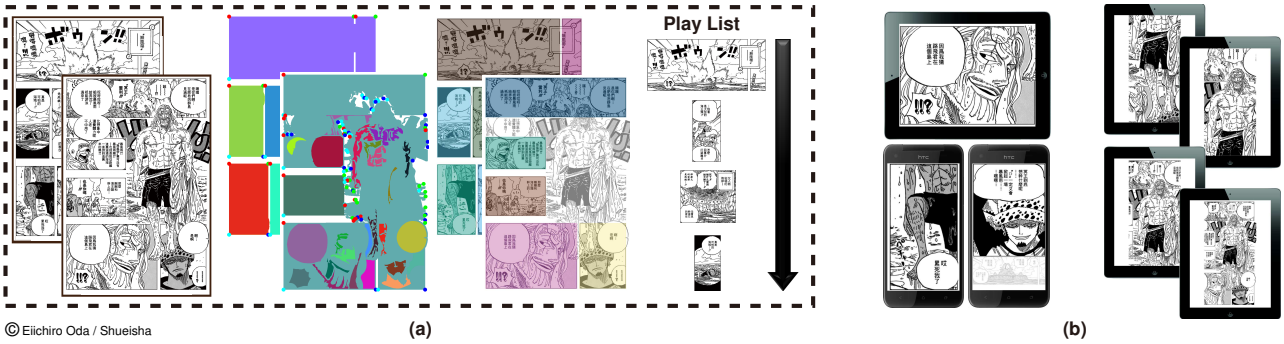

Figure 1: *(a) Using* ***corner matching algorithm*** *to extract the all panels in the manga, even it is the breakout panel. (b) Re-layout the panels of the manga on the arbitrary devices, and users could use simple gestures to read manga easily and clearly.*

1 Introduction and Motivation

In the present day, smart phones and tablets are popular electronic devices for business, entertainment or study due to their convenience, portability and intuitive user interfaces. However, these advantages also induce one of their limitations: the limited available screen size. It is not comfortable to read articles, mangas, magazines,...etc, under such a small screen. Figure 1 shows the overview of our system. Before our work re-layouts a manga, the system must first extract all panels in the manga through our designed **corner matching algorithm**, sort the extracted panels into a queue, i.e a play list, based on the generally accepted manga reading rules and transform panels in the list to display under arbitrary accessing conditions.

2 Our Approach

In the past, several algorithms[Yamada et al. 2004; Chan et al. 2007; Li et al. 2013] have been proposed to extract all panels of one page in a general case but they cannot properly segment all panels out when there exists the case of "breakout" panels which are used for emphasis of some specific situations or special effects, such as the showing up of an important character or a critical play for the leading role, by the artists. Our work can overcome this limitation with the following steps. We use a connected-component labeling algorithm to get initial partitions of the manga and the rough partitions can help to precisely locate the corners of panel boundaries using **Harris Corner Detection**. Then, for each detected corner, we would traverse its bi-direction along the boundary edges in short distance as its matching vectors, such as the Figure 1(a) shown. Through careful observation the shape of a manga panel is always a convex polygon, and thus, each corner of a panel can find its neighboring two corners based on the inner product of its matching vectors with other corners' matching vectors. When the value of the inner product between two matching vectors is equal to -1, the two corners is labelled as a pair and connected to form the real boundary of a panel. The process is repeated until we find all real boundaries of each panel and extract all panel precisely, even when there exist some breakout panels as shown in the Figure 1(a).

In the last, all panels must be displayed onto a screen with an arbitrary size under an arbitrary accessing direction with the requirement of clearly presenting all content and text in a panel to viewers. Our algorithm resize the panel based on the screen size and the selection of the vertical or horizontal accessing direction of the mobile device. When selecting a direction and a screen size, we could find a scale ratio, α, to uniformly deform each panel area, P^a, accordingly to fit screen of mobile device. In order to fill the screen of mobile device with area, M_a, Eqn. 1 is used to estimate how many panels could be displayed in the selected screen size and reading direction and the currently chosen panel.

$$E = \arg\min_{n} \; M_a - \sum_{i=1}^{n} \alpha_i P_i^a, \;\; E > 0 \qquad (1)$$

Although some empty space may be left when following Eqn. 1, this action could guarantee that the original meaning of the manga layout and the presented order be maintained. The left space would be filled in the following panels in the play list with the transparent state. To summarize the entire work, we propose an automatic method to extract all panels of a manga, and re-layout the panels of a manga to make accessing easier and more clear than a traditional manga reader on a mobile device.

References

CHAN, C. H., LEUNG, H., AND KOMURA, T. 2007. Automatic Panel Extraction of Color Comic Images. *LNCS, Advances in Multimedia Information Processing*, 775–784.

LI, L., WANG, Y., TANG, Z., AND LIU, D. 2013. Comic image understanding based on polygon detection. *Proc. SPIE 8658, Document Recognition and Retrieval XX 8658* (Feb.), 86580B–86580B–11.

YAMADA, M., BUDIARTO, R., AND ENDO, M. 2004. Comic image decomposition for reading comics on cellular phones. *IEICE Transaction on Information and Systems*, xx, 1–8.

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