Drawing Graphs Using Body Gestures*

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Abstract. We introduce a new gesture-based user interface for drawing graphs that recognizes specific body gestures using the Microsoft Kinect sensor. Our preliminary user study demonstrates the potential for using gesture-based interfaces in graph drawing.

Traditional input devices for manual data entry of graphs include mice, keyboards, and touch screens. Humans naturally communicate using body gestures. Recent research explores body or *mid-air* gestures as a form of interaction, particularly when using traditional input devices may be unintuitive or undesirable. Inspired by advances in gesture-based input technologies, we investigate the application of mid-air gestures to graph drawing. We created a prototype system called KiDGraD (using **Ki**nect to **D**etect skeletons for **Gra**ph **D**rawing), which uses a Microsoft Kinect to recognize a limited set of body gestures designed to allow the user to manipulate a graph's nodes and edges. We conducted a preliminary user evaluation examining the perceived naturalness of our proposed gesture set and users' attitudes towards our general approach. Feedback from this initial user study suggests that gesture-based graph drawing has a number of potential applications, motivating future research into improved recognition capabilities as well as effective and expressive gesture sets.

Prior research on gesture-based interactions has focused on both gestures on digital surfaces (e.g., multi-touch gestures on digital tables [3]) and on mid-air gestures, where sensors and cameras are used to detect body movements (e.g., [1, 2]). There is limited prior research examining the effectiveness of traditional keyboard and mouse interfaces for inputting and editing graphs. Several such software systems exist, but few of these have been evaluated with published user studies. Furthermore, few previous systems apply non-traditional user interfaces for drawing or editing graphs from human input without any initial digitally stored representation of the graph. To the authors' knowledge, this work is the first to examine a mid-air gesture-based user interface for graph drawing.

The KiDGraD user interface includes a drawing area, consisting of a grid illustrating the graph and overlayed with a sketch of the user's detected skeleton, a sidebar to access commands, and a header that displays the active command. The system implements five operations: adding nodes, deleting nodes, adding

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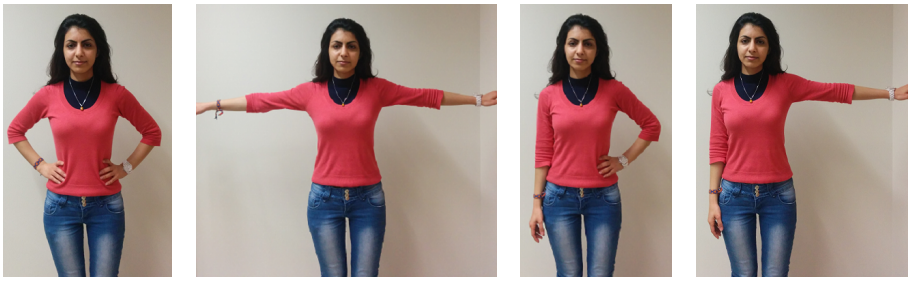
edges, deleting edges, and reset. A user can activate commands in one of two ways: performing the corresponding gesture (see Fig. 1) or using the sidebar.



(a) (b) (c) (d)

Fig. 1: The Add Node, Add Edge, Delete Node, and Delete Edge gestures.

As a first proof-of-concept exploration of our gesture-based approach to graph drawing, we conducted an informal usability study with ten participants. The goals of the study were to gain initial insight into the intuitiveness and ease of the gestures, as well as to elicit feedback from users on the potential strengths and limitations of this approach. We asked participants to interact with KiDGraD by drawing a number of sample graphs, after which we solicited feedback on both the system concept and the gesture set.

Participants responded quite enthusiastically to the system and the idea of using gestures to draw graphs. With mean responses of 4.0 or greater on the 5-point scale, participants appeared to find the system fun, simple to use, and relatively efficient. Responses for comfort and the system working as participants expected were slightly less positive. In the post-session interview, we probed further in terms of what users liked and did not like about the approach. Almost all participants felt that the idea of using gestures to draw graphs is interesting, and they were excited to move away from using mice or keyboards.

References

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