Proceedings of ACM Symposium on Applied Computing (SAC 2000), pp. 570 - 573, March 2000, Como, Italy.

Tournament Selection for Browsing Temporal Signals*

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Abstract

Presentation of audio or video files for browsing is difficult due to their serial and transitory nature whereas texts or photos may be simply placed in the user's visual field. This paper describes a simple technique for browsing and selecting among temporal signals such as audio and video. In the proposed method, only two among a set of the signals are presented to the user at a time and (s)he just needs to select a 'winner' among the two. This process is repeated for many rounds until a single winner remains as analogous to the tournament match in many sport games. We applied this intuitive technique to browsing and selecting among computer-animation clips for motion parameter setting. It would also be applicable to browsing/selecting among retrieved candidates in audio/video retrieval systems.

Key Words: browsing, retrieval, tournament, multimedia, audio, video, user interface.

1 Introduction

Browsing in a visual user interface takes advantage of the fact that a variety of artifacts may be placed in the visual field and the user can rapidly scan them, as well as use peripheral vision to obtain some sense of the objects not in the immediate visual focus [8]. Presentation of a set of retrieved items is usually done this way in image retrieval systems [5][6]: the user can rapidly scan them and choose the best among them. However, presentation of temporal signals such as audio or video files for browsing is made difficult by the serial and transitory nature of them. As opposed to the static display, audio/video files must be played over time. Presenting many audio/video files at a time to the user, hence, have some difficulties. Resources are often not available enough for the simultaneous playbacks. Listening/watching many audio/video clips simultaneously is hardly an easy task for human users.

There are some attempts to get around these problems such as spatialized audio presentation [8] and graphical display of a key-frame extracted from each of video files [3] or computer animation clips [5]. Even these get-arounds have, however, their own problems. The spatialized audio burdens the human user on frequent recalling from spatial memory in the absence of visual cues. It is not always possible to extract a key-frame that represents the entire video/animation clip well enough. We present a simple and intuitive way of browsing the temporal signals without much load on the user's memory nor the non-representative simplification such as the key-frame extracting. In Section 2, the idea of tournament browsing is explained and Section 3 presents its application to interactive evolution system of computer animation clip. Discussion and Conclusions follow it.

2 Tournament Browsing and Selection

Initially, the entire set of the candidates is in the tournament: in a retrieval system, this set would correspond to that of retrieved items which are highly ranked for a given query. Two candidates are selected and presented for playback to the human user. The user just needs to choose a 'winner' among the two. Only the winner progresses to the next level of the tournament. The tournament continues until a single winner remains. The ranking of a candidate is its height in the playoff tree (Figure 1). The one at the top is then the favourite choice of the user. The total number of 'competitions' for a set of n candidates is $n - 1$.

We experimented this tournament browsing technique in our interactive evolution system of generating variations on a prototype motion in 3D computer animation.

3 Interactive Evolution of Motion

Motion control of articulated figures such as humans has been a

*This work is supported in part by PAVR under the EU Training and Mobility of Researchers program.

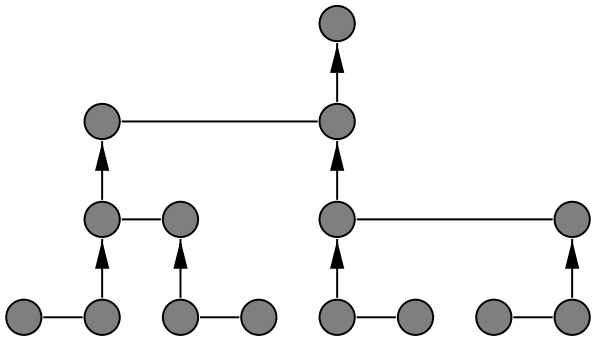


Figure 1: Tournament selection and ranking. Each horizontal line designating a competition and each upward arrow designating the winner progressing in the tournament. The ranking of a candidate is its height in the playoff tree. (Adopted from [1].)

challenging task in computer animation [2]. Once an acceptable motion segment has been created, either from key-framing, motion capture or physical simulations, reuse of it is important. Much of the recent research in it has been directed towards mixing those selected from a library of example motions to create a new motion [7][13]: for example, a library of walk motions. Though it greatly expands the range of possible motions, it is difficult to acquire the examples in the beginning: it still has to go through tedious key-framing, motion capture or physical simulations. Using interactive evolution, a genetic algorithm technique, however, we can synthesise more example motions from a single prototype motion such as different walk styles out of a normal walk motion without tedious user specifications, design efforts, or knowledge of algorithmic details. This can be useful since it is much easier than animating from scratch.

Application of interactive evolution in computer graphics is hardly new. For example, it is used very effectively in creating beautiful and abstract colour images [9]. An initial population of images generated randomly by the computer is displayed on the screen. From the displayed set the user determines a relative fitness ranking. The mating and/or mutation operations are applied to the selected images based on the ranking to produce a new set of progeny images, that supply the input for the next round of user selection. This process is repeated multiple times, to evolve an image of interest to the user.

When applying this interactive evolution technique to animation, displaying population of animation clips to the user faces the problems discussed in Section 1.

3.1 Experiment

In our interactive evolution system of motion[4], the initial population consists of random variations on a given prototype animation clip. Only two among, say, eight animation clips in the population are shown at a time whereas all of them would be displayed on the screen simultaneously when evolving images or shapes [9][12]. The human user just needs to click what (s)he favours over the other and repeat this process for each pair of animation clips presented (Figure 2.) Once the final winner is determined this way, the ranking for each candidate is used as its relative fitness. Then, the rest of other processes are similar to those of other interactive evolution applications [9][12]. The mating and/or mutation operations are applied to the selected motions based on the ranking to produce a new set of progeny motions, that supply the input for the next round of user selection. This process is repeated multiple times, to evolve a motion of interest to the user.

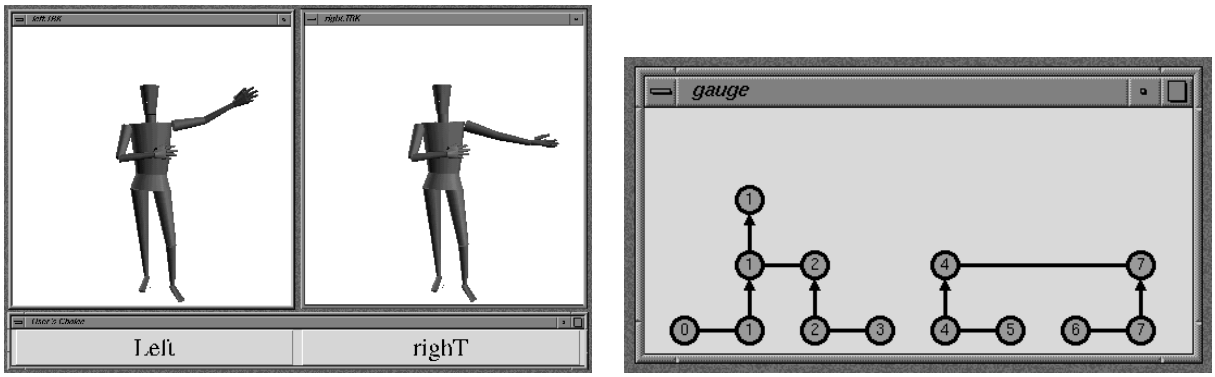
We use a humanoid model of 62 degrees of freedom both animated and rendered using an in-house software based on OpenGL: description of other details about the system is beyond the scope of this paper. Figure 3 shows the snapshots of the original prototype motion and its variations generated by the interactive evolution system: it took only a few minutes or dozens of mouse clicks for reaching the shown variations.

4 Discussion and Conclusion

This tournament scheme contains a sort of noise associated with its ability to rank any given set [1]. How accurately the tournament ranks the set depends on the competitors met. If the best candidate in the set competes in the initial round of the tournament with the second best one, only the best one moves up the hierarchy whereas the other being assigned the lowest rank. All the candidates that lose at the same level of the tournament have the same rank, which de-emphasises their ranks relative to each other. This is, however, more beneficial than over-committing to an exhaustingly complete ordering of the set. Resulting tournament hierarchy is sufficient information for our interactive evolution application as described above: selecting the best one, based on user's subjective judgement, among the set of retrieved ones rather than complete reordering of them is often enough in many applications of retrieval systems.

The notion of tournament competition has been also applied to standard genetic algorithms where all the processes including selection of a winner are done in a batch mode without any interactive intervention of the human user [1][10]. While it is all about evolving *better solutions* for complex tasks in a *batch* mode, our novel application reported here is about *user interface* and *usability* in *interactive* systems.

In summary, we have applied tournament selection to browsing a set of animation clips. It gets around the difficulties which presentation of temporal signals such as audio or video files typically faces. It is simple, intuitive and also applicable to retrieval systems



(a) (b)

Figure 2: (a) Only Two at a Time. Two among eight animation clips of motions are presented to the user at a time and the user just needs to choose one among them. (b) Progress Gauge of Tournament. This gauge displays the current status of the tournament.

of sound/video.

5 Acknowledgements

We thank Joaquim Esmerado, Anthony Guye-Vuilleme and Olivier Renault for their helpful discussions.

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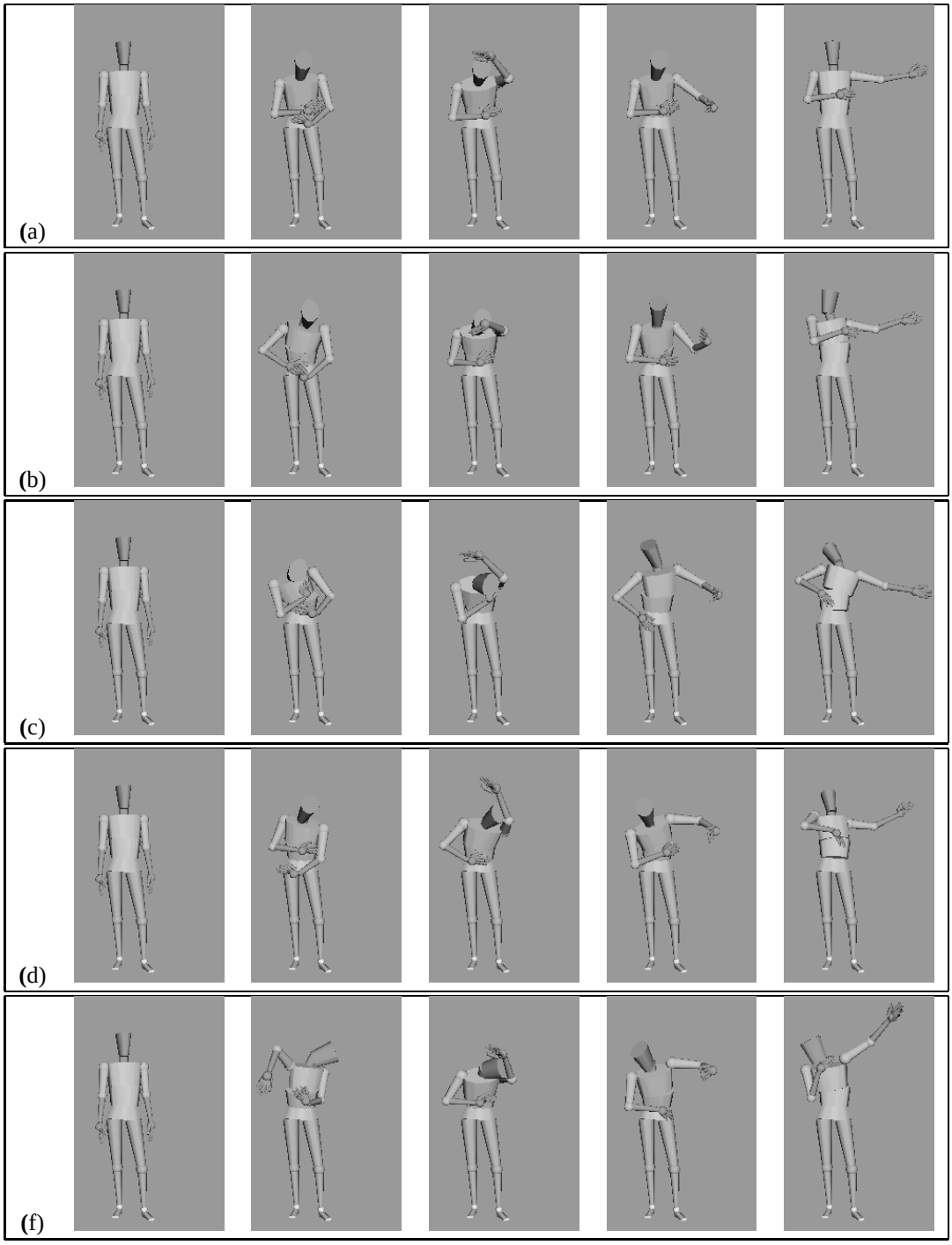

Figure 3: Variations on a Theme. (a) The key frames of the original prototype motion, *come-in*, composed by hands. (b-f) The variations generated out of the prototype using the interactive evolution system.