# **Automated Story Sifting Using Story Arcs**

**Extended** Abstract

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## ABSTRACT

Story sifting (or story recognition) allows for the exploration of events, stories and patterns that emerge from agent-based simulations. The goal of this work is to automate and reduce the authoring burden for writing sifting queries. In this paper, we use the event traces of agent-based simulations to create Dynamic Character Networks that track the changing relationship scores between every agent in a simulation. These networks allow for the fortunes between any two agents to be plotted against time as a story arc. Similarity scores between story arcs from the simulation and a user's query arc can be calculated using the Dynamic Time Warping technique. Events corresponding to the story arc that best matches the query arc can then be returned to the user, thus providing an intuitive means for users to sift a variety of stories without coding a search query. These components are implemented in our experimental prototype ARC SIFT. The results of a user study support our expectation that ARC SIFT is an intuitive and accurate tool that allows human users to sift stories out from a larger chronicle of events produced by an agent-based simulation.

### **KEYWORDS**

Analysis of Agent-based Simulations; Story Sifting; Interactive Narratives; Virtual Agents

#### ACM Reference Format:

Wilkins Leong, Julie Porteous, and John Thangarajah. 2022. Automated Story Sifting Using Story Arcs: Extended Abstract. In Proc. of the 21st International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2022), Online, May 9–13, 2022, IFAAMAS, 3 pages.

### **1** INTRODUCTION

Story sifting (or story recognition) [13] allows for the exploration of events, stories and patterns that emerge from agent-based simulations. A limitation of current approaches to story sifting is that they tend to require manual specification of search queries, e.g. [1–3, 10, 12], in a technical language which can be burdensome for non-technical users. Hence, our motivation in this work was to reduce the authoring burden for sifting stories by providing an intuitive and user-friendly method for describing desired story criteria and an automated approach to using those criteria to sift stories corresponding to those criteria.

We observed that the use of visual representations of stories, i.e. a *story arc* [7, 14, 15], would allow users to describe story criteria by drawing the "shape" of stories of interest. A story arc can be thought of as plotting the changes of character fortunes [14] "for better or worse, over the course of the telling" [7]. The use of such a visual representation would reduce the authoring overhead by removing the need for technical knowledge. The problem then is how to represent sequences of event traces from agent-based simulations which match these story arcs, i.e. the specified criteria.

Our solution to this problem, implemented in a tool we refer to as ARC SIFT, consists of two parts. Firstly, the creation of *Dynamic Character Networks* [4, 5] that track the changing relationships between agents over the course of a simulation. These networks allow for the relationships between agents in the simulation to be plotted against time as *simulation* story arcs. Secondly, the use of the time-series comparison algorithm *Dynamic Time Warping* [8, 9], to calculate similarity scores between simulation story arcs and *query* story arcs (e.g. arcs drawn by users). ARC SIFT returns stories (i.e. sequences of events) corresponding to the simulation story arcs that best match query arcs. When the input query arcs are drawn by users this provides an intuitive means for users to sift a variety of stories without the need to author technical search queries.

## 2 ARC SIFT

To develop our story sifting prototype, ARC SIFT, we implemented components that built Dynamic Character Networks from our Prom Week simulation and integrated this with use of Dynamic Time Warping of Query Arcs.

ARC SIFT consists of the following three inputs: (i) an Abstract Interaction Log (AIL)[1], the output of an agent-based simulation to sift stories from; (ii) a configuration mapping how each interaction type affects the relationship scores between agents; and (iii) an input query story arc, describing the shape of the story of interest. This query arc can be plotted by a user or be computer generated. ARC SIFT uses the first two inputs to create a dynamic character network. From this, the changing relationship scores between agents, arising from their interactions are plotted against time as simulation story arcs for each pair of agents.

ARC SIFT computes a similarity score between a query story arc and all simulation story arcs. ARC SIFT then returns the specific AIL events corresponding to the simulated story arc with the lowest cost score.

## **3 USER STUDY**

We conducted a user study that assessed how intuitive users found the use of story arcs as a mechanism to describe criteria for selecting stories of interest, and the accuracy of Arc SIFTwhen sifting stories.

We set up a multi-agent based simulation that modelled a school prom scenario where agents are looking for prom date, based on [6]. The interaction events from this simulation were captured as output in the form of Abstract Interaction Log. (AIL)[1]. A selection

Proc. of the 21st International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2022), P. Faliszewski, V. Mascardi, C. Pelachaud, M.E. Taylor (eds.), May 9–13, 2022, Online. © 2022 International Foundation for Autonomous Agents and Multiagent Systems (www.ifaamas.org). All rights reserved.

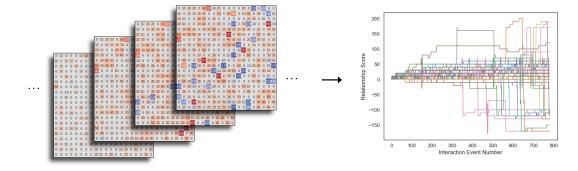


Figure 1: Dynamic Character Networks to Simulation Story Arcs: (LHS) shapshots of a 20x20 Dynamic Character Network from our simulation; (RHS) shows 190 simulation story arcs produced from this Dynamic Character Network.

of stories were then sifted from the simulation using query arcs. These arcs were based on a set of common shapes described in [11].

The study consisted of 20 non-technical adult participants who were proficient English speakers, and was conducted using an online form, with no time limit. The participants were given 2 tasks as follows:

**Task 1:** participants were presented with 6 summarised stories sifted from the Prom Week simulation using ARC SIFT and asked to draw in a free draw box, using a mouse, a story arc that they felt best represented the summarised story presented to them. The user drawn story arcs were collected, analysed according to the following criteria: number of local peaks, local troughs, total inflections, and the direction of the first inflection. These arcs were compared with the original query story arc used to sift the presented stories.

**Task 2:** participants were presented with 6 story arcs. For each story arc presented, participants were asked to select, from a set of multiple choice answers of story summaries, the summary that they thought best matched each presented arc. Participants also had the option for "other" if they felt that none of the choices sufficiently matched the presented story arc.

At the end of each task, participants were asked to provide a confidence score for their answers for the completed task, using a 5-point Likert scale (where 1=low confidence and 5=high confidence). Participants also had the opportunity to provide any explanation for their ratings or general feedback via a free text field.

The results for task 1 and task 2 are summarised in Figure 2. The participant confidence rankings for both tasks are visualised in Figure 3. The following provides a flavour of responses for both tasks: "... watched enough TV dramas to expect those arcs, and anticipate emotions of characters."; "The prompts were easy to read and comprehend whether the story was flowing in a positive or negative direction."; "It was easy to trace the arc as I read the story."

Overall these results gathered from our user study match our expectations that sifting stories using shapes such as a story arc is feasible, and that it is an intuitive and accurate process.

### ACKNOWLEDGMENTS

This research was supported by funding from the Commonwealth of Australia.

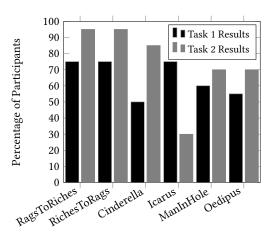


Figure 2: Task 1 Results: % participants who drew story arcs that correctly matched the target query arc. Task 2 Results: % participants who correctly selected the target sifted text story corresponding to a visual story arc.

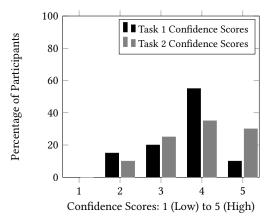


Figure 3: Participant Confidence Scores. For both tasks the majority of participants, 65%, reported feeling confident in their responses. The median rating for both tasks was 4.

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