KnitFit: Amateur Created Custom Knit Garments

Sophie Smith,

Human-Computer Interaction Institute, Carnegie Mellon University

smiso-19@rhodes.edu

Abstract

Knitting custom garments is a time intensive and difficult task. It is difficult for amateurs to create correct patterns, predict the resulting size, and correctly apply textures without ruining the pattern. We want to eliminate the difficult aspects of creating custom knitted garments by having an algorithm decide how to attach different textures together without ruining the pattern created by the user. We provide a series of contributions that make it easier for amateur knitters to create custom garments.

Introduction

The goal of our project is to have a user design their own custom garment through an interface that will then be sent to an optimization algorithm. After the algorithm decides how to connect the different textures without messing up the overall look of the custom garment, the pattern is sent to an industrial knitting machine that will print out the custom garment. We present an interface that allows end users to manipulate and visualize a scarf and apply textures to it to demonstrate the end-to-end goal of our system.

Related Work

A. The Knitting Machine Compiler [1]

The knitting compiler allows a user to use high level shapes to build knitted object without having to deal with the low level machine instructions such as needle placement. It gave people a way to easily interact with industrial knitting machines that they would normally have trouble controlling. Industrial knitting machines can perform a wide range of tasks, but only if the user knows how to program it. The paper explains how most objects that the knitting machine can make use tubes and sheets. By abstracting knitted objects into tubes and sheets, its allows the compiler to add short rows to connect the neighboring tubes and sheets and then generates knitting assembly language instructions. Much like this paper, we try to make it easier for nonprofessionals to have access to creating custom objects on an industrial knitting machine.

B. Stitch Mesh [2]

Much like the Stitch Mesh paper, we try to visualize knitted garments on a computer screen. However, Stitch Mesh included relaxation and other methods which increased the time it took to visualize the textures far beyond real time. Our goal is different than Stitch Mesh because we are not focusing on complete accuracy when visualizing the knit garment, but rather giving the user an idea of what the texture looks like before and on the garment in the interface. Doing this is real time is more important than having completely accurate representations of knit garments.

Overall Approach

Given the task of creating an interface for the knitting compiler, I had to become familiar with Java and Processing, a tool to build GUIs. I had to learn how to use Processing, a tool to create interfaces, as well as the language it uses, Java. I watched the online tutorials for

Processing and another GUI builder that we ended up not using. I also browsed the web for some sort of inspiration on how to design an interface for the user. I found a site I liked and thought was very user friendly and tried to create an interface like it using Processing. I created clickable buttons, interactive sliders, and an image scrollbar. After successfully creating an interface similar to the one I found online, I had to change the interface to work with the code base on the back end of the program. I simplified the existing interface into basic objects that would then talk to the backend of the program. I also created a button that would save everything a user did and create a JSON file that sends that information to the optimization function. With the JSON files acting as a link between the multiple parts of the system, we created an end to end system which allows a user to design their own garment and have it optimized and then knitted by an industrial knitting machine.

Results

The interface is interactive and connects to the back end of the system. The user is able to choose the height and width of a scarf garment and then place textures from a list onto the garment in any fashion they like. They also determine if they want the texture stretched to its max, at a normal resting state, or somewhere in between. Once they hit the optimization button, it creates a JSON file that gives all the necessary information about the customized garment to the optimization algorithm. The algorithm then decides, taking in the user's preferences, how to connect the different textures while still maintaining the overall height and width of the garment.

Conclusion

With this interface, amateur knitters can create custom garments without having to worry about compromising the look of the overall garment by incorrectly sizing the different textures. However, due to the industrial knitting machine's limitations, we cannot knit every texture that a hand knitter could. The user is also limited to the texture patterns that we provide for them. Overall, this system allows someone with minimal knitting experience to create a custom garment.

We are also writing a formal research paper on this project to submit to the CHI conference but it will not be available until September.

Acknowledgements

I would like to express my gratitude toward my faculty mentor, Professor Jen Mankoff. Thank you for including me with this project. I also thank the DREU program for assisting in the funding of this project, and Rhodes College for preparing me for this experience.

References

[1] MCCANN, J., ALBAUGH, L., NARAYANAN, V., GROW, A., MATUSIK, W., MANKOFF, J., HODGINS, J. 2016. A compiler for 3D machine knitting.

[2]YUKSEL, C., KALDOR, J. M., JAMES, D. L., AND MARSCHNER, S. 2012. Stitch meshes for modeling knitted clothing with yarn level detail. ACM Trans. Graph. 31, 4 (July), 37:1–37:12.