Robotic Recycling of Clothing
A Human-Centered Approach

University of Canberra, ACT, Australia

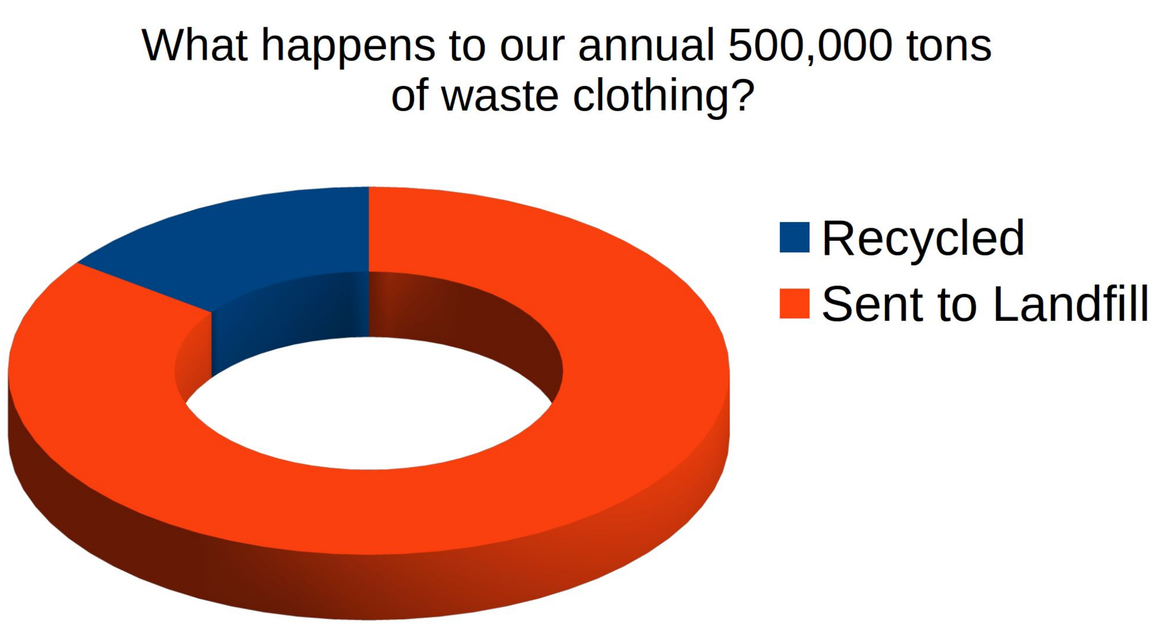
David Hinwood, Damith Herath

UNIVERSITY OF CANBERRA

The Problem Description

Each year Australia alone throws away 500,000 tons of clothing waste. At an optimistic estimate, 15% of these textiles are recycled while the remaining 85% is sent to landfill (Figure 1). This is not only wasteful, it is unnecessary as there are chemical processes that exist today and are ready to be utilised for recycling most existing textile waste. There are many practical uses for clothing waste including insulation, cheap garments or brand new eco-friendly clothing. This presents the key question of why so much waste is being sent to landfill. The anecdotal reason given for this situation being that it is not a profitable endeavour to use human labour to recycle clothing and it is generally cheaper to send our waste overseas or to landfill.

Figure 1. A visualisation of Australia's current textile waste recycling ratio



The Approach

The proposed project will attempt to integrate robotic technologies within a human-in-the-loop context to handle much of the manual labor required for preparing waste clothing for downstream processes to recycle them. This includes the removal of non-textile components and recognition of a material composition. This project will be built upon previous research conducted including the CloPeMa (Clothing Perception and Manipulation) project and other textile automation based research such as a clothing folding system constructed within Berkeley University using a Willow Garage PR2 robotic unit.

The algorithms built in these projects developed a practical base to build upon for the mechanisms of clothing manipulation and perception. However there are still gaps in the requirements for use of robotics in textile recycling. These include the aforementioned issues on non-textile components and compositional detection on top of integration with chemical processes. This also involves determining how well suited a robot would be in this work environment along with an evaluation of human labour required within the recycling process. An industry and process evaluation will be the first step to building an optimal workflow.

Additionally this project has the potential to be one of the first of many robotic systems integrated within dynamic environments working alongside humans in a novel and practical industrial context. The long term benefits of such a system will anticipate 5% total reduction from our landfills and will not significantly affect the existing human workforce associated with the recycling industry. Such a human centered approach also augers well with the norms of societal progression where in the proposed integrated system encourages building a circular economy with brand new clothing being made from the discarded garments.

Image 1. Simulated Test Setup