Computer Vision Based Analysis of Broccoli for Application in a Selective Autonomous Harvester

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Abstract

As technology advances in all areas of society and industry, the technology used to produce one of life's essentials—food—is also improving. The majority of agriculture production in developed countries has gone from family farms to industrial operations. With the advent of large-scale farming, the automation of basic farming operations has increasingly made practical and economic sense.

Broccoli, which is still harvested by hand, is one of the most expensive crops to produce. Investing in sensing technology that can provide detailed information about the location, maturity and viability of broccoli heads has the potential to produce great commercial benefits. This technology is also a prerequisite for developing an autonomous harvester that could select and harvest mature heads of broccoli.

This thesis details the work done to develop a computer vision algorithm that has the ability to locate the broccoli head within an image of an entire broccoli plant and to distinguish between mature and immature broccoli heads. Locating the head involves the use of a Hough transform to find the leaf stems and, once the stems are found, the location and extent of the broccoli head can be ascertained with the use of contrast texture analysis at the intersection of the stems. A co-occurrence matrix is then produced of the head and statistical texture analysis is performed to determine the maturity of the broccoli head. The conceptual design of a selective autonomous broccoli harvester, as well as suggestions for further research, is also presented.

Acknowledgements

First and foremost, I would like to thank God, without whom there would be no broccoli and thus, no thesis.

I would also like to thank my advisor, Dr. Reinholtz, who has always demonstrated kindness, extreme patience and ingenuity. He has consistently given me the incredibly practical advice that I am often too blind to see and provided a living example of how an honorable man should act in the face of adversity. His dedication to his students and his support with their every project are, and will always be, greatly appreciated.

Next, I would like to thank Brinkley Benson, the "experienced broccoli researcher," who spent many hours classifying the maturities of broccoli heads with me as well as answering hundreds of broccoli questions, ranging from the obvious to the ridiculous.

I would like to thank my parents, Mark and Janice Ramirez, for raising me and supporting me throughout college. And finally, my fiancé, Rick Bis, who was always there to answer questions about revolute joints and LabVIEW; who continues to force me to eat broccoli and even made a broccoli cake for my birthday and who was a bottomless pit of ideas, whenever I reached the end of my rope.

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