Robot Forest Pathologist: Autonomous Robotic Complex for Forest Monitoring

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Forest monitoring is crucial for prevention of wildfires and control of tree pathologies. The monitoring of remote forest regions by humans can often be complicated or impossible. Thus, development of a robot capable of autonomous collection of data of trees in a forest is one of the most important and one of the most emerging tasks for forestry robots - there are no existing robots of this type. In the framework of development of a prototype of the forestry robot the aim of my research was to conceptualize mechanical construction of a prototype and to develop prototype algorithms and software. The developed RobotC software controls 12 motors on six legs as well as two caterpillars. The prototype is equipped with a camera on rotating mechanism. Horizontal position of the camera is used to classify tree species in real time with the help of a convolutional neural network implemented in C++ and trained on the cloud with publicly available dataset. When in motion, camera is directed down, recording a video stream of the ground. This video stream is processed to estimate prototype position in real time by analysis of keypoint movement in adjacent frames and to detect insects with yet another neural network. Tree detection and trunk measurement are done by infrared and ultrasonic range sensors also controlled by RobotC software. Field testing showed that with my algorithms and software the prototype satisfies functional requirements for forestry robot. Neural networks showed good performance will be developed further aiming industrial applications.

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