

PROF. DR. DIRK JAEGER

Advanced Virtual Aptitude and Training Application in Real Time (AVATAR)

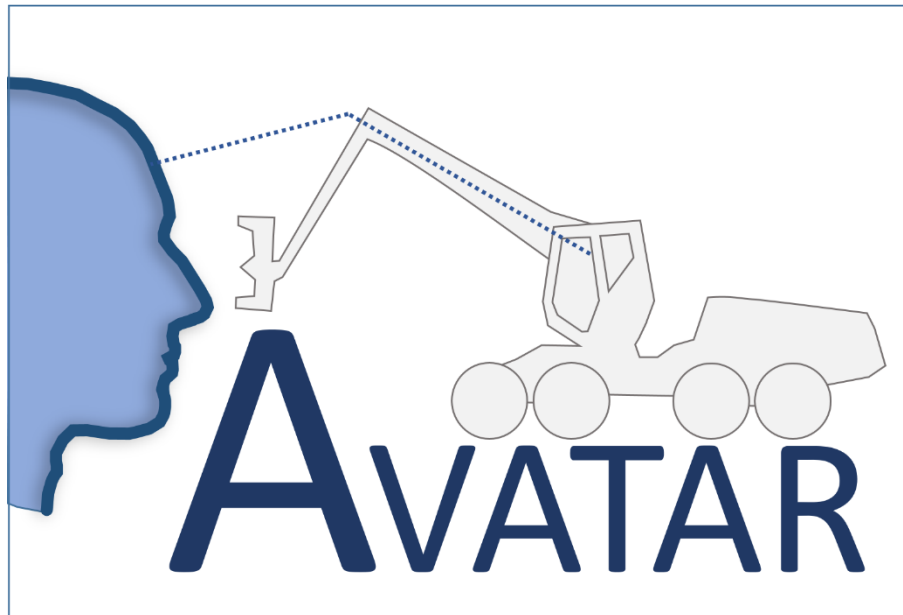
Midterm Seminar
November 17 and 18, 2020



Super complex work environment of machine operators



AVATAR Goal



- **Within the project AVATAR, a digital coaching, assistance and feedback system is designed for improving productivity and job satisfaction of forest machine operators**

AVATAR – Project objectives

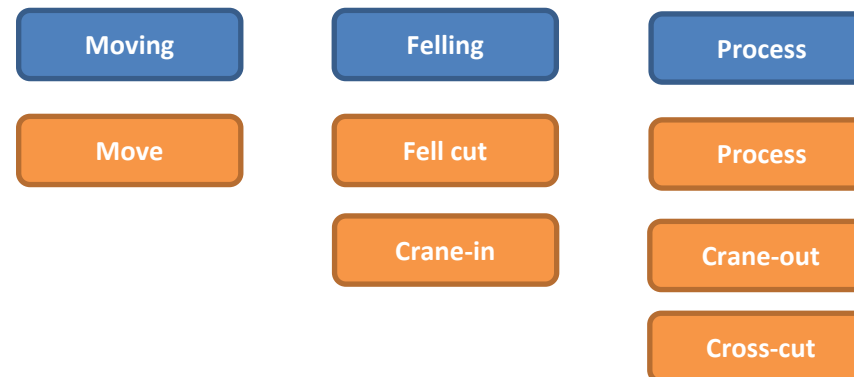
- Reduce training and skills demands on new operators while reducing workload on skilled operators
- Broaden the operator base by contributing to a more accessible, balanced and attractive work environment for both genders
- Clarify which data are most closely associated with individual performance and how these can be gainfully used within the GDPR framework
- Unlock the full potential of current production systems and thereby substantially reduce cost of biomass supply
- Increase detail data capture on European forests through promotion of CTL systems running StanForD
- Promote R&D cooperation within and between Scandinavia and central-Europe

Activities carried out, so far (examples)

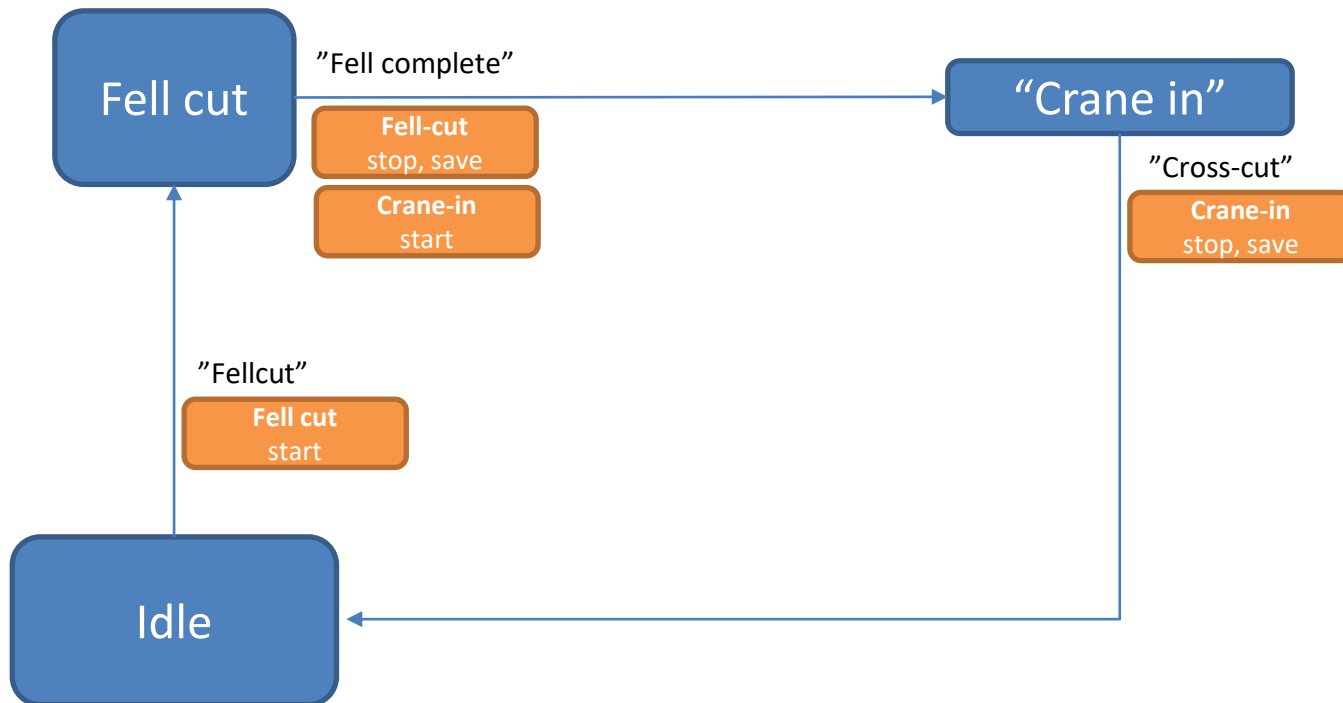
- Analyzing machine activities and identifying work elements, Skogforsk
- Quality control for improved recovery of timber, Skogforsk
- Identification of detrimental work pattern, joint activity
- Factors influencing loading times of forwarders, Göttingen

Analyzing machine activities and identifying work elements

Three machine activities
Six tracked work elements



Analyzing machine activities and identifying work elements

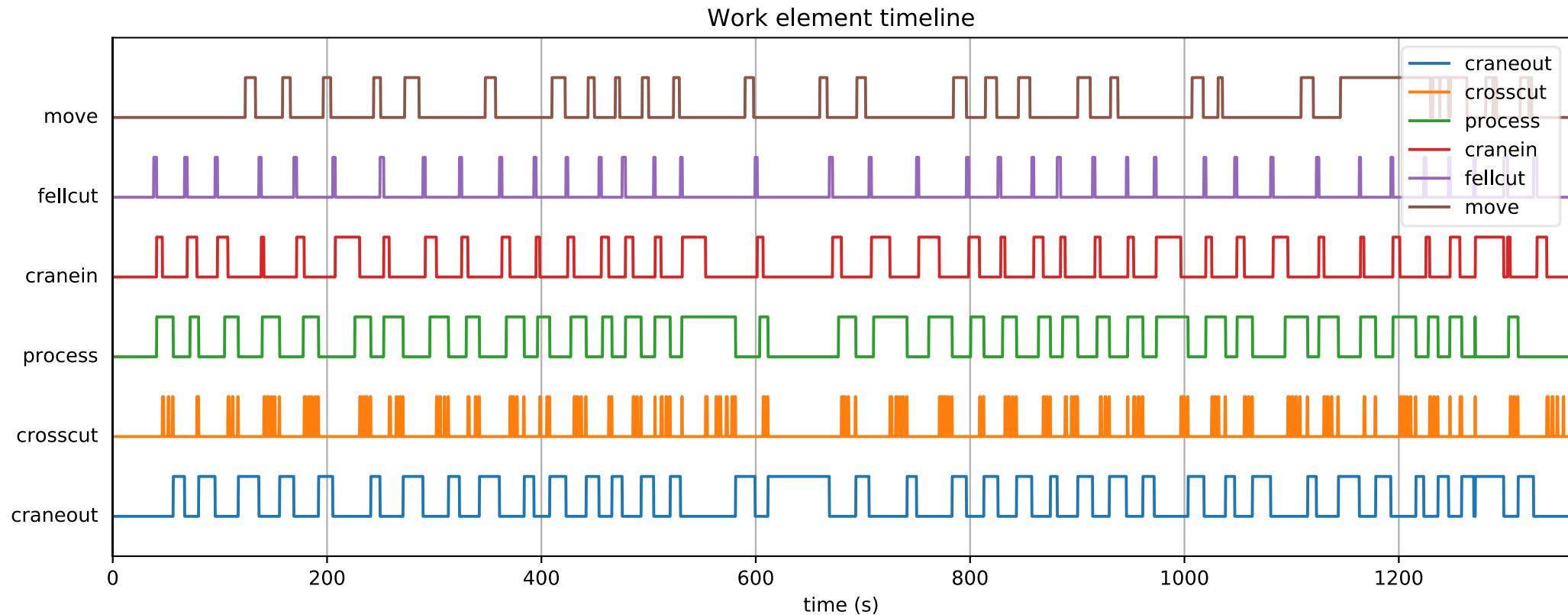


"Fellcut":
LockedAtTiltUpPosition == True AND
SawPosition > a AND
MAX-d > UpperKnifePosition > MIN+d

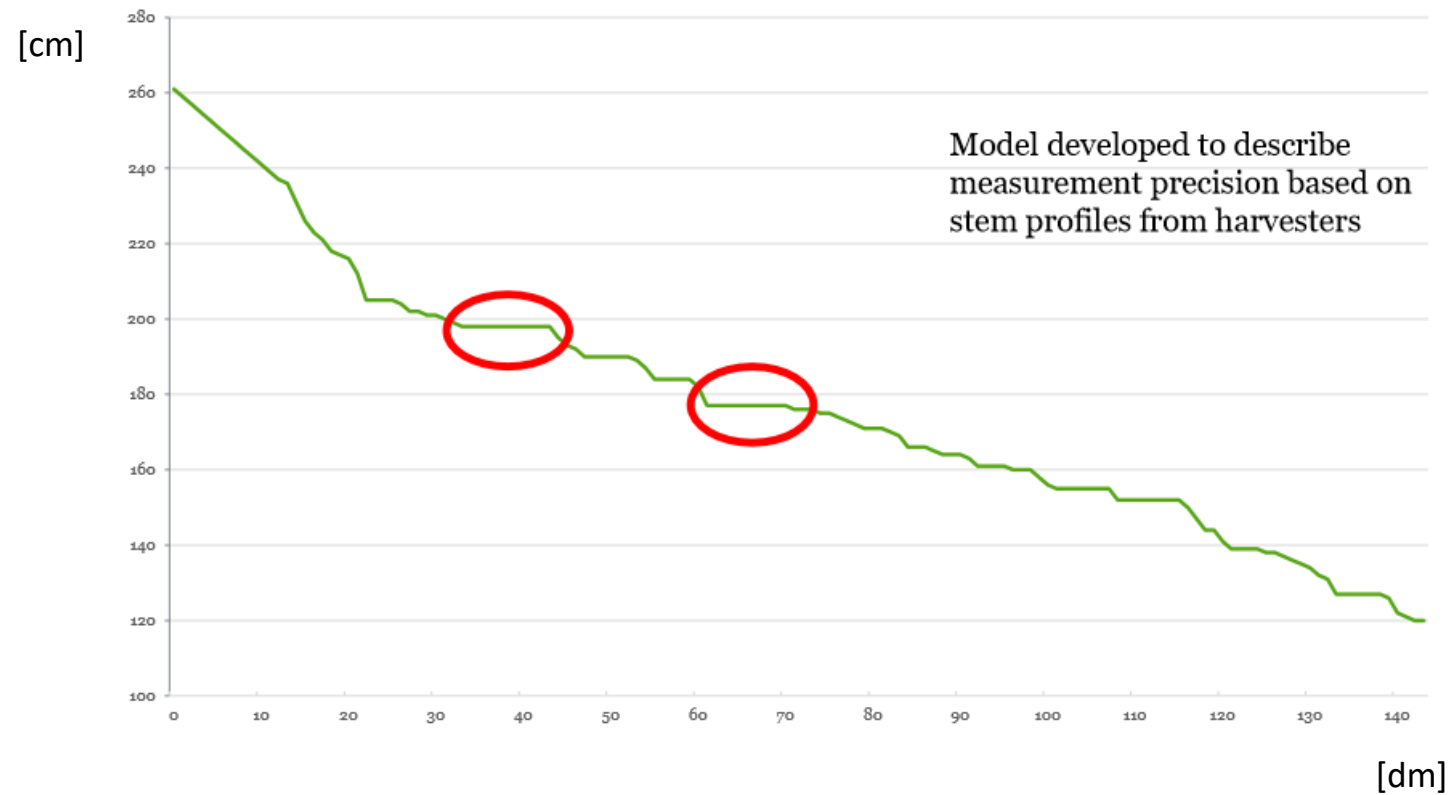
"Fell complete"
SawPosition < a AND
(FeedPosition Delta > 0 OR
Boom Tip Position DELTA > X)

"Cross-cut"
SawPosition > a AND
TiltUp == False

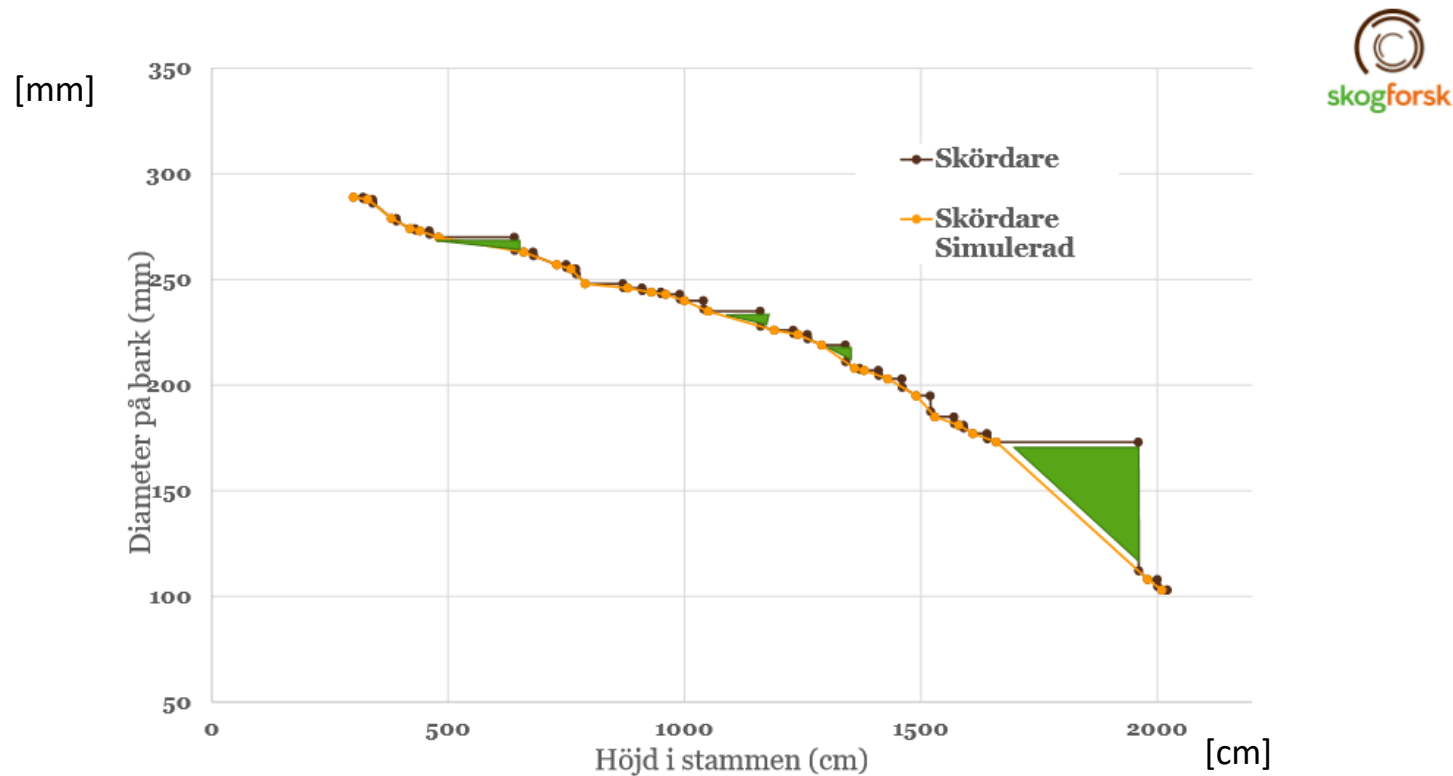
Analyzing machine activities and identifying work elements



Quality control for improved recovery of timber



Quality control for improved recovery of timber

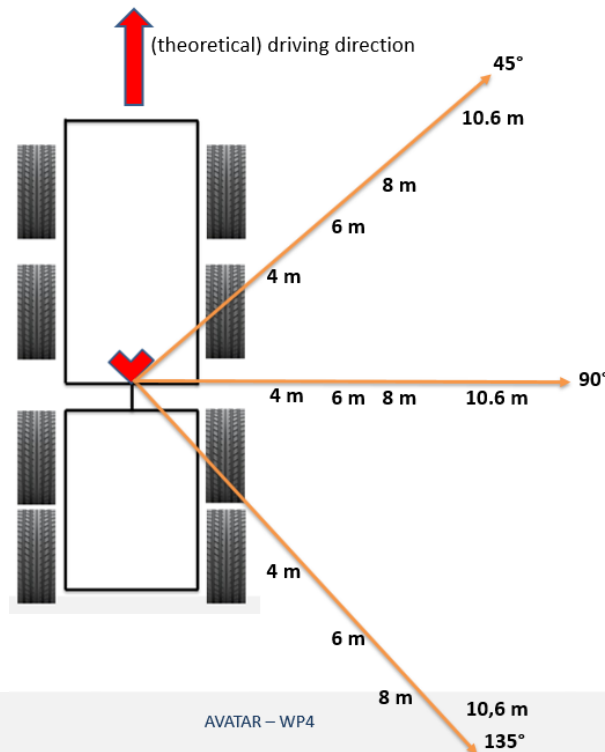


Identification of detrimental work pattern

Type	Category	Description of (negative) work practice
Harvester	Positioning and reaching for trees	Reaching too far ahead to fell trees (also processing). The crane is too slow when reaching far
Harvester	Positioning and reaching for trees	Unnecessarily reversing the machine to bring more trees to a pile
Harvester	Felling	Felling into a direction where you can't see the rot immediately
Harvester	Felling	Assortment piles should be laid out in a fan pattern. There should be no distance between the logs at the end facing the road, but around 1,5 meters at the other end
Harvester	Crane use	Using the extension too late when reaching for a tree
Forwarder	Crane settings	Crane speed too high
Forwarder	Crane skill	Not using the extension enough/sporadically/only when you cannot reach. It should be used in most movements
Forwarder	Unloading	When loading/unloading unnecessarily lifting the empty grapper over the supports instead of going between

Factors influencing loading times of forwarders

a) Log orientation



32.84 seconds

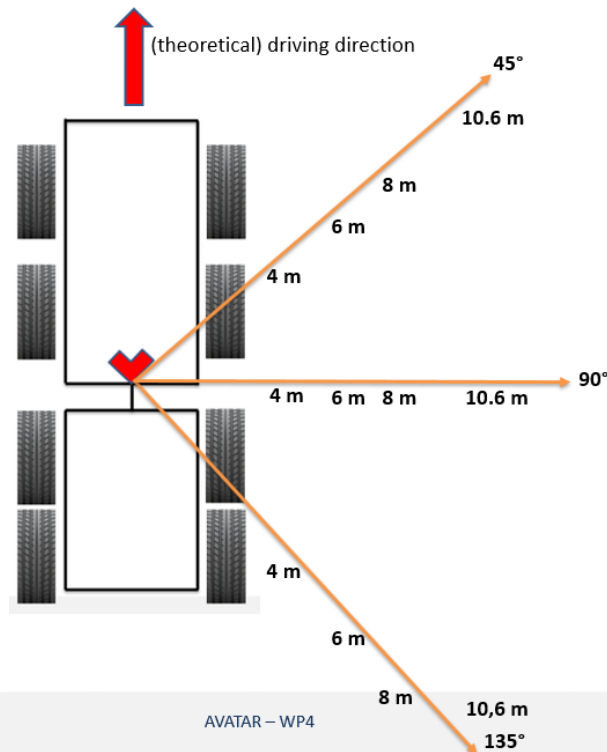
(loading time average all distances, all angles, logs parallel to driving direction; n=90)

31.78 seconds

(loading time average all distances, all angles, logs 90°-angle to driving direction; n=90)

Factors influencing loading times of forwarders

b) Use of telescope of crane



28.73 seconds

(loading time average 4 and 6 m,
all grapper angles, both log
angles, without telescope; n=60)

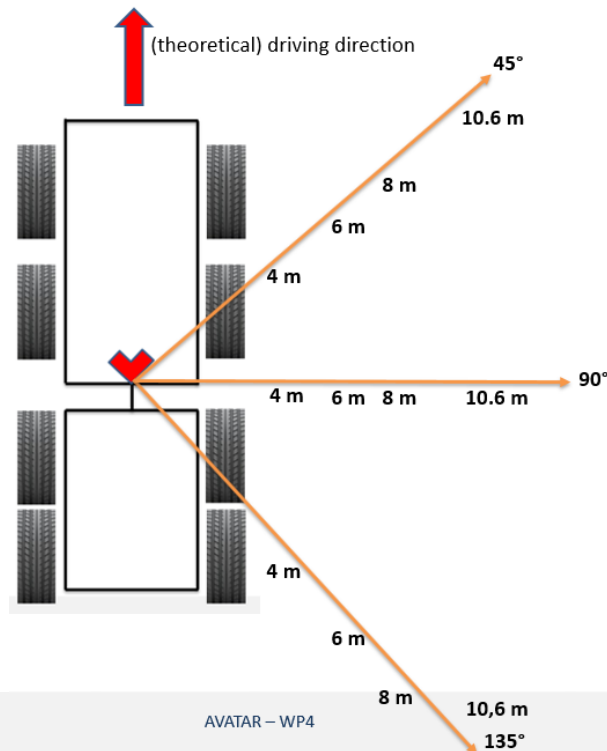


26.19 seconds

(loading time average 4 and 6 m,
all grapper angles, both log
angles, with telescope; n=60)

Factors influencing loading times of forwarders

c) Angle of crane-out



30.50 seconds

(loading time average all distances, 45°, both log angles, with and without telescope; n=60)

(45°)

37.60 seconds

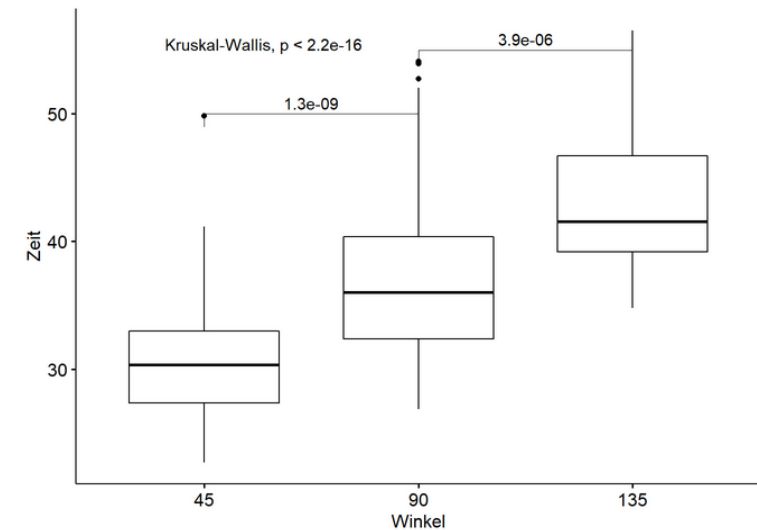
(loading time average all distances, 90°, both log angles, with and without telescope; n=60)

(90°)

43.25 seconds

(loading time average all distances, 135°, both log angles, with and without telescope; n=40)

(135°)



Exploitation perspectives

- Digital coaching, assistance and feedback system for machine operator is urgently needed
- Even single system components are of high added value for efficient, productive and enjoyable machine operations

Dissemination activities

- ForestValue Kickoff-Meeting in Helsinki, Finland: May 23-24, 2019
- German Summer School on Human Factors in Ulm, Germany: August 1-2, 2019
- 52. International Symposium on Forestry Mechanization (FORMEC) in Sopron, Hungary: October 6-9, 2019.
- NB Nord 2020 Conference in Helsingør, Denmark: September 22-24
 - Englund, M.; Rossander, M.; Hartsch, F.; Hoffart, E.; Dreger, F.; Björheden, R.; Manner, J. (2020): Automatic Detection of Work Elements and Disadvantageous Work Practices in Mechanized Forestry.
 - Khaksar, W.; Nowell, T.; Talbot, B.; Astrup, R. (2020): Direct Multi-Tree Stem Detection and Analysis from Terrestrial Lidar Data.

COVID-19 best-practices implemented to minimize its effects



AVATAR sensor equipment mounted on a stroller (NIBIO)