Soil protection can be improved through appropriate infield driving

Infield route planning in harvesting operations aiming for soil protection

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MAIN INPUTS

Bond Re5

Field geometries:

- Boundary
 - Reference lines for the tracks

Santiago Focke Martinez

INTRODUCTION

The goal is to generate routes for the harvesters transport vehicles participating in a and operation harvesting based the field on parameters, the machines' dimensions and capacities, and a specified optimization strategy. The strategy presented here aims to avoid driving over areas with high soil compaction (cost) and to reduce transit over previously driven areas.

Information about the route planner can be found in [1]

METHOD

the divided planning process İS into The computation of the following:

- (surrounding) headland.
- headland and inner-field tracks.
- harvester route disregarding capacity constraints (no transportation).
- search graph based on track points.
- final routes including the infield transit, overload, and transportation activities.
 - Non-working segments generated based on the optimization criterion.

RESULTS

The figures bellow show the route planning results for a silage maize harvesting operation, with one noncapacitated harvester and one transport vehicle. The routes were generated based on two optimization strategies: optimize driving time penalizing changing tracks (TO) and increase soil protection (SO).

- Access points
- Unloading locations

Field state parameters:

- Biomass gridmap or average biomass in the field
- Soil-state costmap

Machines:

- Working width
- Mass
- Capacity limits
- Speed

Planning parameters

- Headland width (minimum)
- Cost parameters
- Track-points distance

EDGE COST FUNCTION (SO)

Time Optimization (TO)

Soil Optimization (SO)

Planned routes for the transport vehicle



Soil-state costmap



$C = d \cdot m_{\Sigma} \cdot \left(K_b + K_s \cdot c_s + K_t \cdot v^{-1} \right)$ $m_{\Sigma} = m + K_w \cdot \sum m_{prev}$

d : edge distance \boldsymbol{v} : speed *m* : mass of current machine m_{prev} : mass of previous machine *c_s* : soil cost (from map) **K**_b, **K**_s, **K**_t, **K**_w : coefficients

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DFKI GmbH, Laboratory Niedersachsen Plan-Based Robot Control Prof. Dr. Joachim Hertzberg

E-mail: pbr-info@dfki.de

www.dfki.de

santiago.focke@dfki.de