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Predicting Crop Yield from Pre-Harvest Satellite Imagery

Master's Thesis (15 ECTS)

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Predicting Crop Yield from Pre-Harvest Satellite Imagery

Abstract:

Creating automatic and accurate forecasts of crop yield using satellite imagery has been the subject of hundreds of studies across decades, starting from the first Earth observation satellite which focused specifically on land monitoring, launched by the United States Landsat program. While these forecasts can help agricultural workers allocate their resources and provide timely estimates of production, the data required to facilitate the training of analogous prediction models is not easily attainable. Thus, no such large-scale model has been made for agricultural environments pertaining to Estonia.

In this work, we utilize the field data provided by eAgronom to consider the prediction of field-scale crop yield, with focus on winter wheat fields in Estonia and Poland from 2018 to 2022, both as a pre-harvest estimate and post-harvest data validation. Through creating a data pipeline that combines Sentinel-2 satellite time series data with other field metadata, we train and compare various learning methods to ultimately report the first state-of-the-art Estonian crop yield model. The resulting pipeline and model benefits both eAgronom, by providing a multipurpose product, and farmers, by improved decision-making.

Keywords:

agriculture, neural networks, remote sensing

CERCS:

P176 Artificial intelligence, T181 Remote sensing

Põllusaagikuse ennustamine satelliidipiltidelt

Lühikokkuvõte:

Satelliidipiltide abil automaatsete ja täpsete saagikusennustuste tegemine on olnud aluseks mitmetele teadustöödele, mille suge ulatub esimese tsiviilotstarbelise maavaatlusprogrammi, Landsati algusaegadesse. Täpsed ennustused võimaldavad põllutööde lihtsustamist nii ressursside planeerimisel kui ka hinnanguliste tootmismahdade varajasel raporteerimisel, kuid andmete kogumine, mis ennustumudeli treenimist tagaks, ei ole lihtne. Seetõttu pole seni loodud mudelit, mis oleks rakendatav Eesti põllumajanduslikus kontekstis.

Magistritöös kasutatakse eAgronomi kogutud Eesti ja Poola põldude andmeid aastast 2018 kuni 2022, fookusega talinisul, et luua vastavate riikide põllusaagikusi ennustav mudel. Eesmärgiks on nii viljakoristuseelne ennustamine kui ka varasemate aastate saagikusandmete valideerimine. Kaasates eAgronomi andmetele Sentinel-2 satelliidipiltide ajaseeria, treenitakse ja võrreldakse erinevaid masinõppel põhinevaid lähenemisi, seejuures luues esimene Eesti põldudele keskenduv tipptasemel saagiennustumudel. Valminud mudel on kasulik nii eAgronomile, võimaldades mitmekülgsema teenuse pakkumist, ning lõppkasutajatele, kes saavad hõlpsamalt jälgida oma põldude käekäiku.

Võtmesõnad:

põllumajandus, tehisnärvivõrgud, kaugseire

CERCS:

P176 Tehisintellekt, T181 Kaugseire

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