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Alessandro Farbo

Home : Via Baltimora 69, 10137, Turin, Italy

Email: alessandro.farbo95@gmail.com **Email:** alessandro.farbo@unito.it **Phone:** (+39) 3505101931

Date of birth: 09/01/1995 **Nationality:** Italian

WORK EXPERIENCE

[01/11/2022 – Current]

PhD Student

University of Turin

City: Turin

Country: Italy

PhD student at Department of Agricultural, Forest and Food Sciences.
The main research themese revolve around remote sensing for precision agriculture applications, crop and environmental monitoring.
I'm in charge of remote sensing and geomatic branch for the PSR research project TELECER alongside the supervisor Prof. Enrico Corrado Borgogno Mondino.

[05/07/2021 – 31/10/2022]

Researcher

University of Turin

City: Turin

Country: Italy

I was in charge of the remote sensing and geomatic branches for the PSR research project TELECER alongside the supervisor Prof. Enrico Corrado Borgogno Mondino.

EDUCATION AND TRAINING

[01/10/2018 – 23/04/2021]

Master degree in agricultural science - Sustainable crop management

University of Turin https://en.disafa.unito.it/do/home.pl

Address: Largo Paolo Braccini 2, 10095 , Turin, Italy

[01/10/2014 – 23/04/2018]

Bachelor Degree in Agricultural and Forestry Sciences and Technologies

University of Turin https://en.disafa.unito.it/do/home.pl

Address: Largo Paolo Braccini 2, 10095 , Turin, Italy

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English

LISTENING B2 **READING** C1 **WRITING** B2

SPOKEN PRODUCTION B2 **SPOKEN INTERACTION** B2

French

LISTENING A2 **READING** A2 **WRITING** A2

SPOKEN PRODUCTION A2 **SPOKEN INTERACTION** A2

DIGITAL SKILLS

Microsoft Office | Microsoft Word | Microsoft Powerpoint | Social Media | IBM SPSS - IBM Analytics | SAS Analysis | SAGA Gis | Google Earth Engine (GEE) / Google Earth Pro | QGIS | Python

PUBLICATIONS

[2022]

Preliminary concerns about agronomic interpretation of NDVI Time series from Sentinel-2 data: phenology and thermal efficiency of winter wheat in Piemonte (NW Italy)

Reference: DOI:10.5194/isprs-archives-XLIII-B3-2022-863-2022

TELECER project is supported through Rural Development Programme regional action of EU CAP and is aimed at providing

Precision Agriculture–devoted services for cereals monitoring in the Piemonte Region (NW-Italy) context. In this work authors

explored some general and preliminary issues mainly aimed at demonstrating and formalizing those evident relationships existing

between NDVI image time series and the main ordinary agronomic parameters, with special focus on phenology and thermal

efficiency of crops as related to Growing Degrees Day (GDD). Winter wheat was investigated and relationships calibrated at field

level, making possible to spatially characterise environmental and management effects. Two different analysis were achieved: (i) one aimed at mapping crop phenological metrics, as derivable from NDVI S2 time series; (ii) one aimed at locally modelling relationship linking GDD and NDVI to somehow test the thermal efficiency of crops in the different parts of the study area. The first analysis showed that the end of season appears to be the most constant phenological metric in the study area possibly demonstrating a time concentration of harvest operations in the area. Differently, the peak of season and the start of season metrics showed to be largely varying in the study, thus suggesting to be stronger predictors: (i) of crop development; (ii) of the effects induced by local agronomical practices. Several base temperatures were used to compute correspondent GDD. These were tested against NDVI and modelled by a parabolic model at field level. Model coefficients distribution were analysed and mapped the correspondent agronomic interpretation suggested.

[2022]

Spectral Measures from Sentinel-2 Imagery vs Ground-Based Data from Rapidscan© Sensor: Performances on Winter Wheat

Reference: https://doi.org/10.1007/978-3-031-17439-1_15

Precision agriculture can be supported by different instruments and sensors to monitor crops and adjust agronomic practices. Remote sensing and derived vegetation index are one of the main techniques that allows to derive related-vegetation information. In this work the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Red-Edge index (NDRE) derived by active handheld Rapidscan© (RS) and passive Sentinel-2 (S2) sensors were compared focusing on the wheat crop. To deal with different sensor wavebands centers, different S2 wavebands were considered and two different NDVI and four different NDRE derived by S2 data were computed. The comparison between RS and S2 was performed during three phenological stages of wheat: first node, flowering and milk. In each period, RS-derived indices were modelled to estimate the S2 ones. Results show that the best conversion models found was linear. In addition, a high correlation and R2 (>0.7) coefficient was found, except during flowering stage. Results confirm the opportunity to scale data and related agronomic information from ground sensor to satellite improving decision support system in agriculture.

[2022]

Geometric vs Spectral Content of RPAS Images in the Precision Agriculture Context

Precision agriculture (PA) has been defined as a new type of agriculture that looks for climate, environmental, economic, productive and social sustainability. This is said to be possible supporting traditional agriculture with new technologies like Geographic Information System, Global Navigation Satellites Systems (GNSS), digital photogrammetry and remote sensing. PA can therefore support farmers to maximize the cost-benefit ratio in yield production (Lambert and Lowenberg-De Boer, 2000). Prescription maps (PMs) are widely used in PA to map crop intra-field anomalies to better address fertilisation, irrigation and phytosanitary treatments. The aim is minimizing negative externalities and maximising yield. As far as remote sensing is concerned, multispectral information from aerial or space platforms can effectively support PMs generation, depending on a proper choice of the adopted sensor in terms of spatial, spectral, radiometric and temporal resolution (Boccardo et al., 2003). Costs associated to aerial and RPAS-based acquisitions are known to be difficult to be estimated since strongly dependent on the required data processing level and size of the imaged area (Perz and Wronowski, 2019). Nevertheless, they can provide a very high spatial resolution typically ranging from 0.5 m to 1 cm and make possible 3D measures thanks to their stereoscopic capabilities. This peculiarity can be proficiently exploited to integrate spectral information. This can be generally achieved assuming digital surface models as additional discriminants effective for deriving information about canopy and biomass of surveyed crops. As far as multispectral features from RPAS sensors are concerned they certainly represent a potential breakthrough in PA. Several spectral indices (SI) can be generated for providing valuable vegetation-related information. Two of the mostly used SIs in PA are the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Red Edge Index (NDRE). They are known to be effective for monitoring of vegetation physiology (Seo et al., 2019), estimation of crop production (van Klompenburg et al., 2020), monitoring of crop nitrogen (N) content (Song et al., 2020). An extensive list of multispectral imaging sensors can be easily found on market the most of them acquiring bands in the VNIR (400-1000 nm) spectral range. MAIA S2 (MS2) is one of the most performing ones in terms of spectral resolution. MS2 acquires 9 bands in the range 390-950 nm using 9 separated optical systems equipped with filters (Marinello, 2017) that are aligned to the ones of the Sentinel 2 MSI sensor. To explore the potentiality of MS2 from drones to generate useful information in agriculture, a pilot experience was achieved focusing on a corn field managed with three different N fertilisation doses. Both geometric and spectral properties of MS2 were investigated testing their capabilities in detecting the effect of different N doses on maize.

[2022]

Exploring Stability of Crops in Agricultural Landscape through GIS Tools and Open Data

Reference: https://doi.org/10.1007/978-3-031-10545-6_23

Climate change is a well-known issue in both the scientific community and public opinion that, in the long term, could increase frequency and intensity of extreme weather events. Several models have been developed to estimate damages caused to crops by flooding, but most of them assume that crops are stable and unchanged over time.

Conversely, yearly crop rotation is known to be common in agricultural areas making potential flooded areas highly varying along years. In a flood damage estimation context, a proper mapping of actual crops in flooded areas is crucial to make deductions reliable. Open data from institutional players, yearly updated, can be proficiently used for this purpose, providing useful information for a more robust estimate of damages. In this work, with reference to a paradigmatic area located in the western part of the Piemonte Region (NW-Italy), stability and spatial pattern of variability of crops was investigated by coupling spatial information from cadastral maps and crop type information obtained for free from the Regional Geoportal and Agriculture Register service, respectively. Investigation considered the period 2015–2020 and was achieved by comparing crop type maps (generated at parcel level) along time. The proposed methodology is expected to be useful for assessing land use intensity. Results showed a great rate of crop variation in the area, suggesting that, to obtain a robust damage estimation in case of flood, crop type maps have to be yearly updated.

[2022]

A Fast Regression-Based Approach to Map Water Status of Pomegranate Orchards with Sentinel 2 Data

Reference: https://doi.org/10.3390/horticulturae8090759

Midday stem water potential (Ψstem) is an important parameter for monitoring the water status of pomegranate plants and for addressing irrigation management. However, Ψstem ground surveys are time-consuming and difficult to carry out periodically over vast areas. Remote sensing, specifically Copernicus Sentinel 2 data (S2), offers a promising alternative. S2 data are appropriate for Ψstem monitoring due to their geometric, temporal and spectral resolutions. To test this hypothesis, two plots were selected within a pomegranate orchard in southern Italy. A pressure chamber was used to collect Ψstem measurements on four days in summer 2021. Ground data were compared with the temporally closest S2 images with the aim of testing the effectiveness of remotely sensed imagery in estimating and mapping the Ψstem of pomegranate plants. Regression models were applied with a limited number of ground observations. Despite limited ground observations, the results showed the promising capability of spectral indices (NDVI, NDRE and NDWI) and S2 bands in estimating (MAE ≅ 0.10 MPa and NMAE < 10%) Ψstem readings. To understand the dimensional relationship between S2 geometric resolution and the orchard pattern, predictive models were tested on both native S2 data and on denoised (unmixed) data, revealing that native data are more effective in predicting Ψstem values.

[2022] **Maize water stress monitoring by Sentinel 2 spectral indices**

Remote sensing is a modern and enhanced tool for data acquisition useful for supporting crop

management practices. It provides an accurate picture of crop status during growing season and

highlights stresses. Vegetation indices (VIs) application is becoming quite common due to its capability

of investigating vegetation status and crop production. NDVI (Near Difference Vegetation Index) and

NDRE (Near Difference Red-Edge index) are the most widespread indicators in agriculture, but other

indices such as NDMI (Normalized Difference Moisture Index, El-Hendawy et al., 2017), NDWI

(Normalized Difference Water Index, Jackson et al. 1996) and NDSI (Normalized Difference Snow

Index) could be correlated to the give information soil and crop water content. The main goal of this

work is to monitor the maize response to water stress using VIs detected through mission Sentinel-2

(S2), focusing on productive and qualitative traits.

CONFERENCES AND SEMINARS

[16/06/2022 – 17/06/2022]

D-SITE: Geometric vs Spectral Content of RPAS Images in the Precision Agriculture Context

Pavia (Italy)

[20/06/2022 – 24/06/2022]

ASITA: Spectral Measures from Sentinel-2 Imagery vs Ground-Based Data from Rapidscan© Sensor: Performances on Winter Wheat

Genova (Italy)