### RQ28 Poligonizare NDVI

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| **Descriere** | **Functionalitate noua**  **Obiectiv:** Realizarea unui serviciu REST pentru împărțirea unei imagini satelitare asupra unei parcele agricole in poligoane geografice in funcție de indicele NDVI.  **Scop:** Returnarea rezultatelor către platforma Demeter in zonele A3: Plant Stress Detection si C1: Nitrogen Balanace Model  Preluarea imaginilor din satelit asupra uneiparcele agricole este o metoda foarte eficienta pentru monitorizarea stării de vegetație a plantelor, mult mai precisa si rapida.  **Pași:**   1. Se apelează serviciul nostru, primind ca parametrii de intrare un poligonul geografic in coordonate EPSG:4326 WGS 84 sau un alt sistem EPSG. 2. Se apelează serviciul expus de Terrascope la adresa: <https://services.terrascope.be/wms/v2> prin care se va obține imaginea satelitară NDVI peste parcela de cercetat la data respective daca aceasta exista. Exemplu de apel GET[[1]](#footnote-1). 3. Se convertesc coordonatele geografice ale parcelei in coordonatele matriciale ale imaginii si se decupează, rămânând vizibila doar parcela de interes. 4. Se parcurge imaginea obținuta. Pentru fiecare pixel vizibil se va aloca o nuanța de gri in funcție de clasa NDVI din care face parte. Sunt 3 clase NDVI ce cuprind ca indice NDVI valori intre [-0.08 si 0.34], [0.35 si 0.5], [0.6 si 0.92] si nuanțe de culori precum maro, galben si respectiv verde. Diferențierea dintre nuanțele de verde si maro se va realiza prin diferențele de banda roșie iar cele dintre galben si verde prin diferențe de banda verde. 5. Pentru fiecare nuanța de gri (clasa NDVI) se vor poziționa punctele poligoanelor in zonele de inflexiune a imaginii. 6. Punctele vor fi convertite in coordonate geografice si returnate ca răspuns sub forma de vectori de vectori in format AIM. | |
| Roluri | n/a | |
| Preconditii | n/a | |
| Intrari | Terrascope is the Belgian platform for Copernicus, PROBA-V, and SPOT-VEGETATION satellite data, products, and services. <https://terrascope.be/en>  The Terrasope platform includes:   * Sentinel-1 Synthetic Aperture Radar (SAR) data over Belgium * **Sentinel-2 optical data over Europe** and soon also Africa * Sentinel-3 optical Synergy (SYN) – Vegetation (VGT) data, when they become available * The SPOT-VEGETATION archive * The PROBA-V archive   A standard set op biophysical indicators (**NDVI**, FAPAR, FCOVER, LAI, CCC, CWC) derived from **Sentinel-2** data is offered as value-added data.  The Sentinel-2 mission consists of two polar-orbiting satellites (Sentinel-2A, launched 23 June 2015 and 2B, launched 7 March 2017) that are phased by 180o, ensuring observations per 5 days at the Equator and per **2-3 days at mid-latitudes**. Sentinel-2 is an optical mission with the MultiSpectral Instrument (MSI) on-board, which is dedicated to land surface change observations (crop monitoring and management, vegetation and forest monitoring, etc.), land cover change monitoring, coastal zones observations, inland water and glacier monitoring, as well as ice extent and snow cover mapping.    The following Sentinel-2/MSI data are available in Terrascope:  Vegetation Indicators   * **Normalized Difference Vegetation Index (NDVI)** * Leaf Area Index (LAI) * Fraction of Absorbed Photosynthetically Active Radiation (fAPAR) * Fractional of Vegetation Cover (fCOVER) * Canopy Chlorophyll Content (CCC) * Canopy Water Content (CWC) /data/MTDA/TERRASCOPE\_Sentinel2.   Level 2A   * Reflectance data * Auxiliary data   PV=DN∗slope+offset    Table 1: Characteristics of the NDVI and BIOPAR images and rescaling information. Physical min and max are the physical range that is retained in the output, the Digital Numbers (DN) are the value of the physical min and max after rescaling to BYTE. The slope and offset are the coefficients to use to recompute the physical values from the BYTE output images.  Developers' Guide: <https://docs.terrascope.be/#/Developers/WebServices/Services> | |
| Iesiri |  | |
| Diagrame | n/a | |
| Design |  | |
| Caz de Utilizare | 1.a …  1.a.1. …  1.a.2 …  1.b …  1.b.1. …  1.b.2 … | |
| Reguli de Business | Denumire | Descriere |
| BR01 | Preluarea imaginilor satelitare de la Sentinel 2 – NDVI trebuie sa fie făcută in fiecare zi.  \*Chiar daca satelitul nu livrează imagini zi de zi |
|  | BR02 | Stocarea imaginilor nu va fi posibila daca acoperirea cu nori este peste 50% si va fi evaluata ca fiind nefolositoare.  \* Nori=pixeli albi |
|  | BR03 | Pixelii din intervalul [-0.08 si 0.34] vor fi grupați într-o singura categorie si vor fi reprezentați pe harta in culoarea maro (#a50026). |
|  | BR04 | Pixelii din intervalul [0.35 si 0.5]  vor fi grupați într-o singura categorie si vor fi reprezentați pe harta in culoarea galben (#fee08b). |
|  | BR05 | Pixelii din intervalul [0.6 si 0.92] vor fi grupați într-o singura categorie si vor fi reprezentați pe harta in culoarea verde (#1a9850). |
|  | BR06 | Imaginile preluate de la satelit trebuie sa fie georeferentiate si sa se poziționeze automat peste basemap-ul Inovagria. |
|  | BR07 | Fiecare imagine trebuie sa fie însoțita de data la care a fost preluata de către satelit si afișată.  \* Ideal sa fie afișată intr-un drop-down ce permite selecția si a altei date disponibile si afișarea rezultatului pe harta. Acest procedeu este util pentru vizualizarea evoluției culturii agricole in aceeași parcela. |
| Algoritmi | Denumire | Descriere |
|  | {   "@id": "urn:demeter:AgriParcelRecord:b429c6d4-676f-4807-a6c9-2c6451614c0e",   "@type": "AgriParcelRecord",   "containsZone": [     "urn:demeter:MgmtZone:1001",     "urn:demeter:MgmtZone:1002"   ],  .......  }  {   "@id": "urn:demeter:MgmtZone:1001",   "@type": "ManagementZone",   "code": 0,   "hasGeometry": "urn:demeter:MgmtZone:geo:10001" }, {   "@id": "urn:demeter:MgmtZone:1002",   "@type": "ManagementZone",   "code": 1,  „hasArea” : ... m2 #adaugat   "hasGeometry": "urn:demeter:MgmtZone:geo:10002" },  {   "@id": "urn:demeter:MgmtZone:geo:10001",   "@type": "POLYGON",   "asWKT": "POLYGON ((2.658972849564151 50.95792999214172, 2.659091082268864 50.95776685575894, 2.658703633207661 50.95765484590413, 2.658585399495478 50.95781798185575, 2.658972849564151 50.95792999214172))" }, {   "@id": "urn:demeter:MgmtZone:geo:10002",   "@type": "POLYGON",   "asWKT": "POLYGON ((2.659091082268864 50.95776685575894, 2.659209314101167 50.95760371922457, 2.658821866047433 50.95749170980091, 2.658717720321181 50.95763540876296, 2.658703633207661 50.95765484590413, 2.659091082268864 50.95776685575894))" },      Bucata de cod Java pentru a le crea este:    // get the NDVI classification polygons for this parcel for (int i = 0; i < polyCount ; i++) {     hasGeom = aimModel.createResource("urn:demeter:MgmtZone:Geom:" + UUID.*randomUUID*().toString());     aimModel.add(hasGeom, RDF.*type*, Geo.*GEOMETRY\_RES* "Polygon");     aimModel.add(hasGeom, Geo.*AS\_WKT\_PROP*, "POLYGON ((2.658972849564151 50.95792999214172, 2.659091082268864 50.95776685575894, " +             "2.658703633207661 50.95765484590413, 2.658585399495478 50.95781798185575, 2.658972849564151 50.95792999214172))");      mgmtZone = aimModel.createResource("urn:demeter:MgmtZone:" + UUID.*randomUUID*().toString());     aimModel.add(mgmtZone, RDF.*type*, FOODIE.*ManagementZone*);      mgmtZone.addProperty(Geo.*HAS\_GEOMETRY\_PROP*, hasGeom);     parcelRecIn.addProperty(FOODIE.*containsZone*, mgmtZone); } |
|  | How to obtain a good NDVI image - Web Map Service (WMS | GetCapabilities, **GetMap**, and GetFeatureInfo      We can use this endpoint to obtain satellite images over a rectangular (bbox) area at **a specified date.**  We can use this endpoint to obtain satellite images over a rectangular (bbox) area at **a specified date.**  Example (**get**) : [[2]](#footnote-2)   |  |  |  | | --- | --- | --- | | **Parameter** | **Info/Format/Obtions** | **Value used in exemple** | | service |  | WMS | | version | Protocol version number | 1.3.0 | | request | GetCapabilities, GetMap, GetFeatureInfo | GetMap | | layers |  | CGS\_S2\_NDVI | | format | PNG, GIF, JPEG, Scalable Vector Graphics (SVG), Web Computer Graphics Metafile (WebCGM) | image/png | | time | yyyy-mm-dd | 2021-02-14 | | width |  | 1920 | | height |  | 592 | | bbox |  | 556900.9710290054,6657998.9149440415,  575290.8578174476,6663655.255037144 | | styles |  |  | | srs | CRS, EPSG and AUTO2 | EPSG:3857 |     To get the **date** that contains the best NDVI image over our surface in a period of time, we can use the following endpoint (suggested by Bausen Bart)  Exemple (**post**) : <https://services.terrascope.be/timeseries/v1.0/ts/TERRASCOPE_S2_NDVI_V2/geometry>   |  |  |  | | --- | --- | --- | | **Parameter** | **Info/Format/Obtions** | **Value used in exemple** | | startDate | yyyy-mm-dd | 2021-02-01 | | endDate | yyyy-mm-dd | 2021-03-01 |   with the body : {"type": "Feature","geometry": {"type": "Polygon","coordinates": [[[27.200385,45.910219],[27.208742,45.911713],[27.209557,45.906502],[ 27.201703,45.905016], [27.200385,45.910219]]]}}  The JSON coordinate parameter contained in the body represents the closed polygon (starts and ends with the first point) of interest in [[[lon, lat]]] format  The ResponseBody contain an array of statistics per day in form of {'result': {'totalCount': 1261, 'validCount': 506, 'average': 0.43582608695652175}, 'date': '2020-09-02'}   * totalCount – total number of pixels in the specified polygon * validCount – number o pixels that are not clouded in the specified area * average – average NDVI index of validCount pixels (“NaN” if validCount = 0) * date – the date in that   Extracting the best statistic with the highest validCount from the list will offer the date that will generate the best NDVI image in our time interval over our polygon. |
|  | How to obtain a histogram of a NDVI image | A histogram represents a frequency vector of pixels group by an index (NDVI).  The histograms of the images that appear during a span of time can be obtained throw the endpoint using the same body : [[3]](#footnote-3)   |  |  |  | | --- | --- | --- | | **Parameter** | **Info/Format/Obtions** | **Value used in exemple** | | startDate | yyyy-mm-dd | 2021-02-01 | | endDate | yyyy-mm-dd | 2021-03-01 |   with the body : {"type": "Feature","geometry": {"type": "Polygon","coordinates": [[[27.200385,45.910219],[27.208742,45.911713],[ 27.209557,45.906502],[27.201703,45.905016], [27.200385,45.910219]]]}}  If we want to obtain the histogram of a single image we can narrow the date interval to zero, using only one date for both parameters. [[4]](#footnote-4)  More information about last two endpoints can be found at : [[5]](#footnote-5) - swagger UI |
|  | Legenda |  |

1. https://services.terrascope.be/wms/v2?service=WMS&version=1.3.0&request=GetMap&layers=CGS\_S2\_NDVI&format=image/png&time=2021-07-14&bbox=3027805.88,5765105.34,3028959.60,5766239.96&srs=EPSG:3857&styles=&width=81&height=80 [↑](#footnote-ref-1)
2. https://services.terrascope.be/wms/v2?service=WMS&version=1.3.0&request=GetMap&layers=CGS\_S2\_NDVI&format=image/png&time=2020-06-01&width=1920&height=592&bbox=556945.9710290054,6657998.9149440415,575290.8578174476,6663655.255037144&styles=&srs=EPSG:3857 [↑](#footnote-ref-2)
3. https://services.terrascope.be/timeseries/v1.0/ts/TERRASCOPE\_S2\_NDVI\_V2/geometry/histogram?startDate=2021-02-01&endDate=2021-03-01 [↑](#footnote-ref-3)
4. https://services.terrascope.be/timeseries/v1.0/ts/TERRASCOPE\_S2\_NDVI\_V2/geometry/histogram?startDate=2021-02-19&endDate=2021-02-19 [↑](#footnote-ref-4)
5. https://proba-v-mep.esa.int/api/timeseries/apidocs/resource\_TimeSeriesServiceV11.html https://proba-v-mep.esa.int/api/timeseries/apidocs/ui/index.html#/ [↑](#footnote-ref-5)