Ag-Analytics

TILLAGE IDENTIFICATION^{BETA}

API Documentation 2021

Service Overview

The Ag-Analytics® Tillage Model API uses artificial intelligence algorithms to determine whether a field has been tilled at a certain date of the year. The Tillage Model API provides service by considering satellite imagery, field location, and time of the year.

The Tillage Model is a "backfilling model", meaning that it can determine whether a field was tilled in the past, rather than provide prediction as to whether a field will be tilled. The model uses a seven-week window of satellite imagery, so as long as the date requested is more than three weeks prior to the current date (i.e., if today is Monday of the 20th week of the year, the latest request that can be made is for the 16th week.).

This document includes information about a POST request, which returns a tillage prediction for the date passed, and a GET request for returning a file of the tillage raster that was generated during the POST request. The returned file is geospatially oriented according to the coordinate system specified in the POST request return and can be displayed in a GIS application.

Model Specifications

The Tillage Model predicts tillage using one of two models that have been trained on approximately 2,000 tillage records from real farming operations. The dataset of tillage operations is used for ground truthing to create a verification label. Without the ground-truth data, there would be no way to tell the model that it predicted tillage correctly, and no way to determine the accuracy of a trained model.

The models are trained on three categories of data. The first is the location of the field geospatially. Tillage practices may vary in different areas of the country, so the addition of geospatial coordinates can illuminate some of these relationships. The second is the week of the year. In combination with the location of the field, the week of the year can help determine whether a field is able to be tilled at a given time of year. For example, tilling in Florida happens at a different time than in Minnesota. Third, remote sensing satellite imagery is used to find patterns in the ground reflectance that happen before, during, and after tillage. The temporal

reflectance patterns are the primary driver for the tillage model in determining whether the field has been tilled. Currently, the model uses a seven-week window of satellite imagery.

POST Request

POST Request Example – application/json

```
{
"ModelType": "NN",

"SHAPE": "{"type": "Feature", "geometry": {"type": "Polygon", "coordinates": [[[-
89.20283, 40.975719],[-89.203383, 40.975106], [-89.203522, 40.974847],[-89.203658,
40.974521],[-89.203723,40.974241], [-89.208534, 40.971115],[-89.209089,
40.970762],[-89.209108, 40.971493], [-89.209143, 40.972829],[-89.209176,
40.974108], [89.209236, 40.977186], [-89.20442, 40.977285],[-89.199613,
40.977383], [-89.199533, 40.974593], [-89.199484, 40.972729]]]}, "properties":
{"OBJECTID": 5102679,"CALCACRES": 145.08999634,"CALCACRES2":null},"id":5102679}",

"ScalarVariables": {

    "TillageStartDate": "04-23-2018"

}
}
```

Header Parameters

content-type:"application/json"

Request Parameters

Parameter	Data Type	Required?	Default	Options	Description
SHAPE	Geometry, file/text	Yes	--	GeoJSON	Desired area-of-interest.
ModelType	Text String	No	Neural Network	"NN" (Neural Network) "TREE" (Decision Tree)	Type of model to use for prediction. Default is neural network. Not necessary to specify for most cases.
TillageStartDate	Text	Yes	--	Date string mm/dd/yyyy	Tillage start date Must be in years {2014, 2015, 2016, 2017, 2018}. For 2019, must be more than 3 weeks prior to the current date.

ScalarVariables	Dictionary	Yes	--	--	Wrapper dictionary for any variables that need to be included along with ModelType and SHAPE. Does not have avalue itself. Please see sample request for clarification.

POST Response

POST Response Example (Snippet) – application/json

```
{
  "feature_averages": [
    {"Key": "x", "Value": -89.2045206106589}, {"Key": "y", "Value": 40.97395490907695},
    {"Key": "weekOfYear", "Value": 17.0 }, {"Key": "NDVIlag0", "Value": 0.2854981678564071},
    {"Key":"NDVIlag1","Value":0.28270497452021},{"Key":"NDVIlag2","Value":0.2413254219881774},
    {"Key":"NDVIlag3","Value":0.18390155118856},{"Key":"NDVIplus1","Value": 0.24136899364844},
    {"Key":"NDVIplus2","Value":0.3131521662145},{"Key":"NDVIplus3","Value":0.43234145408330},
    {"Key":"NDTIlag0","Value":0.13882370249834},{"Key":"NDTIlag1","Value":0.9419920237052 },
    {"Key":"NDTIlag2","Value":0.18289781969953},{"Key":"NDTIlag3","Value":0.9468203281547},
    {"Key":"NDTIplus1","Value":0.1465078944312},{"Key":"NDTIplus2","Value": 0.2705449224700},
    {"Key":"NDTIplus3","Value":0.9590315644867}
  ],
  "raster_filename": "result_tillageraster_20191127_163228_9503.tif",
  "rasterinfo": [{
      "attributes": {"CellSize": [0.0001,-0.0001],
      "CoordinateSystem": "GEOGCS["WGS 84", DATUM["WGS_1984", SPHEROID["WGS84", 6378137, 298.2
        57223563, AUTHORITY ["EPSG", "7030"]], AUTHORITY ["EPSG", "6326"]], PRIMEM["Greenwich
        ",0],UNIT["degree",0.0174532925199433],AUTHORITY["EPSG","4326"]]", "Extent": "-89.209
        236, 40.969983000000006, -89.19953600000001, 40.977383",
      "Legend": [
        {
          "Area": 283.7703164915481,
          "AreaPercent": "100 %",
          "AreaUnit": "ac",
          "Count": 5914,
          "CountAllPixels": 6511,
          "Till": "No",
          "Value": 0,
          "color": "#261f17"
        }
      ],
      "pngb64": "data:image/png;base64, iVBORw0KGgoAAAANSUhEUgAAAGEAAAABKCAYAAACrbTpWAAAADBUlE
        QVR4nO2cu3HDMAxAIZ9X0KVMl0ZreAHNkCYjufEMWsBruFGnUpcl UtGn8PgTCZIAyNfEF9syiUcQFGVrAMZ8
        fX78Yh5vus3vx6/ngnloK+u2j1fsjnTOc63dAEqYYRv8xO1yvS+GCejQPpg5Rxtbe6Taj9gUl="
    }
  }
]
}
```

Response Parameters

Parameter	Data Type	Description
feature_averages	Dictionary	Average value of each input used to predict tillage.
raster_filename	String	URL to use in GET request to retrieve predicted raster file.
rasterinfo	List of Dictionaries	Container for the features and metadata information for the raster.
attributes	Dictionary	Container for specific features regarding the tillage prediction raster.
CellSize	List	Size of a single cell in the raster in degrees. (0.0001, -0.0001) roughly corresponds to an 8 meter by 8 meter square on the Earth's equator. (i.e., 0.0001 degrees ~= 8 meters)
CoordinateSystem	String	Information about the coordinate system being used for calculations.
Extent	String	Specifies the left bottom corner and right top corner in longitude and latitude respectively.
Legend	List of Dictionaries	List of the metadata features for the areas of the field that returned as till or no-till or both.
Area	Float	Specifies the number of acres that were till or no-till for a given field.
AreaPercent	String	Specifies a percentage of the field that returned either till or no-till. For example, if 50% of the field is "till", then Area is 50%.
Count	Integer	Number of pixels that returned as till or no-till. Used to calculate area.
CountAllPixels	Integer	Total number of pixels that make up the field in the predicted tillage raster.
Till	String	Specifies whether the given section (or entire area) of the field has been tilled. Returns "Yes" for tillage and "No" for tillage not detected.

GET Request

Request Example

The GET request to retrieve the tif image using the file name from the POST response.

```
https://ag-analytics.azure-api.net/tillage-model/?filename= result_tillageraster_
20191126 _175158_3291.tif
```

Request Parameters

Parameter	Data Type	Required?	Default	Options	Description
filename	text	Yes	--	.tif file	file name returned by POST request

Response Parameters

Parameter	Data Type	Description
file	.tif	Tiff file will be download to the computer of the caller with the name that was used to call the API.

Ag-Analytics

Please contact **support@analytics.ag** or **josh@ag-analytics.org** with any comments or questions.

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