Bay Area Environmental Research Institute

Vinay Ravindra <vravindra@baeri.org>

Query about the 3d-chess river network data

5 messages

Vinay Ravindra <vravindra@baeri.org> Mon, Apr 3, 2023 at 8:17 PM
To: geoallen@vt.edu
Cc: "Selva Valero, Daniel" <dselva@tamu.edu>, Benjamin Gorr <bgorr@tamu.edu>, "Aguilar Jaramillo, Alan" <aguilaraj15@tamu.edu>

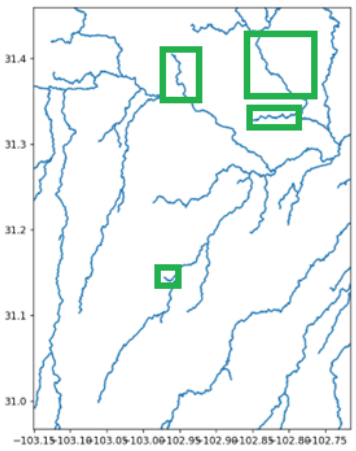
Hi George,
cc Dani, Ben, Alan

Thanks for uploading the data. I have a few queries as I started processing it with python.

There are 2948 'LineString' features. Is it correct to say that they represent a single continuous path made up of straight line segments without any 'breakouts' in between? I.e. they are either leaf branches, or the trunk of a branch?
(I have attached a pic at the end of the email with green boxes marking what I think are the features. Please confirm)

There are 385 attributes associated with each feature: {LINKNO, DSLINKNO, USLINKNO1, USLINKNO2, DSNODEID, strmOrder, Length, Magnitude, DSContArea, strmDrop, Slope, StraightL, USContArea, WSNO, DOUTEND, DOUTSTART, DOUTMID, OUTLINKNO, COMID, w1, w2, ... , w365, geometry}
Is there documentation of what they mean?
I assume w1, w2, ...,w365 are the stream "levels" per day of the year? What are the units, and the date-range?

I searched for the area in Google Maps (lat=31.5, lon=-102), but am not able to find the streams. There are some roads. When I zoom out however I can see dendrite-like structures when I add satellite data layer (of the vegetation?). Are the streams too small to be seen? It is interesting because there is a creek next to my home, and that shows up on Google maps.

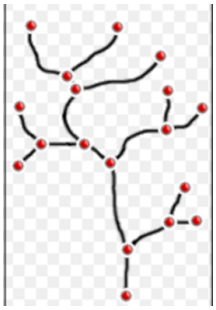


Thanks,
Vinay

George Allen <geoallen@vt.edu> Tue, Apr 4, 2023 at 6:43 AM
To: Vinay Ravindra <vravindra@baeri.org>
Cc: "Selva Valero, Daniel" <dselva@tamu.edu>, Benjamin Gorr <bgorr@tamu.edu>, "Aguilar Jaramillo, Alan" <aguilaraj15@tamu.edu>, Molly Stroud <mollystroud@vt.edu>

Hi Vinay,

1) A linestring corresponds to a single stream segment (black) between network nodes (red). The stream segments are not typically straight but follow the sinuous path of a natural stream. The geographic location of the stream segments is given as a series of vertices in the shapefile.



2) If there is documentation for the attribute table, I would need to search around to dig it up. I can do this if needed but here's the quick summary: the first 19 attributes correspond to various features of the river network topology (e.g. which segments are upstream), stream segment geometry (e.g. slope, length), and segment ID (COMID). Correct, the attributes that start with "w" are the modeled stream width in meters. Each column is the day since the start of the model run (start date: Jan 1, 2013).

3) Yes, the streams in west Texas are not typically flowing but their geomorphic channels can be delineated from the satellite imagery by the vegetation. The idea of this 3D-CHESS scenario is that the streams are often difficult to detect without UAV observations. A couple caveats: the stream network that we are using to model streamflow might not be very accurate in this area and the estimated widths are also probably not very accurate either. The data are just pulled from a global-scale model run so there is no local calibration done here.

Hope this helps, hopefully we can chat more during the meeting today.

Cheers,
George
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Vinay Ravindra <vravindra@baeri.org> Tue, Apr 4, 2023 at 4:35 PM
To: George Allen <geoallen@vt.edu>
Cc: "Selva Valero, Daniel" <dselva@tamu.edu>, Benjamin Gorr <bgorr@tamu.edu>, "Aguilar Jaramillo, Alan" <aguilaraj15@tamu.edu>, Molly Stroud <mollystroud@vt.edu>

Thanks George.

What are the units of the length and width of the streams?

I am thinking of using the length (& perhaps even the width if significant) of the stream as part of the cost function. I.e. the UAV shall take more time to scan the lengthier streams.
Do you think there are any other attributes which can affect the UAV scan time?

Regarding the reward (Value), I suppose we want to target the 'wetting' or 'drying' periods, i.e. the change in state of the stream.

Mathematically we could consider the following options:
(1) per-day difference in the stream widths i.e. w(k) - w(k-1), where k is the #day, and w is the stream width.
(2) calculate the difference between the current day, and the average of last N-days, i.e. w(k) - Sum(w_i)/N, where i ranges from (k-N) to (k-1). N=15? 30?

Btw are we interested in imaging the stream itself or the land area surrounding it or both?

Any thoughts or other ideas?

Sorry for the barrage of questions!
Thanks,
Vinay
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George Allen <geoallen@vt.edu> Thu, Apr 6, 2023 at 6:54 AM
To: Vinay Ravindra <vravindra@baeri.org>
Cc: "Selva Valero, Daniel" <dselva@tamu.edu>, Benjamin Gorr <bgorr@tamu.edu>, "Aguilar Jaramillo, Alan" <aguilaraj15@tamu.edu>, Molly Stroud <mollystroud@vt.edu>

Hi Vinay,

No worries, here're my answers:

Units of wetted stream width and length are in meters.

Width and length are probably the most obvious inputs for the cost function. Does stream sinuosity make a difference to UAVs? Is a very windy flight line more expensive than a straight flight? Sinuosity or something similar can be calculated based on the geometry of

the stream segments.

For reward, we are interested in knowing the timing of drying and wetting of the streams. We could tie in other information like proximity to oil wells or population centers, or some sort of ecological value. But that might be more work than what it's worth for this simulation. It looks like your proposed reward functions are focused on change in width, not necessary timing of drying, is that correct? I think this is defendable but it might make more sense to build the reward based on whether the stream has gone from a wet state to a dry state.

For the purposes of the simulation, we are only interested in the steam/stream channel itself, not the surrounding area.

A couple other thoughts: Not sure if your simulation considers sensor type but detection of water in small streams with UAVs is often easiest with a thermal imager, rather than VNIR. Also, if you want higher temporal or spatial resolution simulated reality than daily data that is in this model, there are other simulation products that could be used to estimate river width every 15 minutes. Not sure how much of a time commitment it would be to prepare that data but I thought I should at least mention it.

Cheers,
George

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Vinay Ravindra <vravindra@baeri.org> Sun, Apr 9, 2023 at 12:03 PM
To: George Allen <geoallen@vt.edu>
Cc: "Selva Valero, Daniel" <dselva@tamu.edu>, Benjamin Gorr <bgorr@tamu.edu>, "Aguilar Jaramillo, Alan" <aguilaraj15@tamu.edu>, Molly Stroud <mollystroud@vt.edu>

George, thanks for the inputs .

> It looks like your proposed reward functions are focused on change in width, not necessary timing of drying, is that correct? I think this is defendable but it might make more sense to build the reward based on whether the stream has gone from a wet state to a dry state.

We can prioritize drying over wetting. On those days of the year when there is only wetting (over the entire area), we want some guidance on prioritizing amongst the streams.

> other simulation products that could be used to estimate river width every 15 minutes.

For now we can restrict to the daily updates.

I have updated the UAV scenario description doc:
https://docs.google.com/document/d/1g25tYdkWjFSrO8HwAO1JI6_RhYIfdQ2VtSwT4QhZzV8/edit?usp=sharing
Hope we can agree upon the high level aspects of the coming meeting.

Best,
Vinay

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