

Review of the DataFromSky ACADEMY program

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Abstract – DataFromSky ACADEMY program is educational program offered to schools, universities, educational institutions and training companies. Thanks to this program, students and teachers have access to fully automated traffic data analysis provided by DataFromSky platform that is used by traffic engineers and civil engineering companies worldwide. In past few years more and more teachers and students were asking us for the traffic data analysis for interesting study and research purposes, therefore we have decided to cooperate with institutions to make part of our software easily accessible for them as well. The goal of the program is to introduce modern way of video-analytical tools of traffic data analysis and current trends in traffic engineering. Within this paper we will introduce students and teachers and other potential users of how to access to DataFromSky Platform, and to get in touch with the software, so they know how to use it and what kind of technology is behind it. Our general aim is to spread the word about the platform and program.

Keywords – DataFromSky-DFS, Academy Program, Traffic Data

I. INTRODUCTION

RCE is a firm providing custom built solutions in robotics, computer vision and Embedded Systems. DataFromSky is subsidiary company of RCE systems and many partners in variety of areas. One of the areas is research that DataFromSky supports with the Academy programme for universities which provides them with traffic video analysis and help to researchers allowing them work with top level tools for free. There are currently more than 30 universities around the world using TrafficSurvey analysis for their projects ranging from noise predictions models, traffic safety simulations or impact of Covid-19 on traffic. Another important contribution is that that's to DataFromSky analytics a major dataset called pNEUMA was created which contains more than 500 thousand trajectories from large area in Athens. DataFromSky also has many business partners. They include multiple large consultancy firms for which analyses are done

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regularly such as Roelofs or COWI. DataFromSky has close relationship with both and has implemented new features based on their requests. For the real-time detections the important partners are the IP camera manufacturers and various integrators all over the world. One of the important partners for real-time systems is ATS Traffic from Canada.

The platform Data From Sky consists of several individual products, which can be combined and integrated to each other in functional and complex blocks.

1) Data From Sky AI – Fully automated service for extraction of traffic data from videos (drones, static cameras etc.). The whole process of the analysis is based on Deep Learning and AI. This analysis is processed offline (you shoot the video and analyze data later with our Data From Sky Viewer (license-free software), professional desktop application used for the analysis of movements of objects within the video. This comprehensive freeware tool has been built since the year 2013 and has helped during a lot of research and commercial projects worldwide. DataFromSky AI platform consists of two parts:

- DataFromSky LIGHT – analyzing the video from static cameras on the ground. It can provide comprehensive traffic data such as Origin-Destination matrix, turn-movement counts, gate counting, object classification up to 16 categories in total, trajectories, various export options (Excel, CSV, visualizations), stationary time, recognition of colors of objects and much more...
- DataFromSky AERIAL – analyzing the videos recorded by drones or other UAVs. The most advanced technology for traffic monitoring at the microscopic level. Trajectory & GPS position, speeds, acceleration, Tg&Tf calculation, capacity estimation, Time to Collision, Safety analysis and road user behavior patterns.

The process is easy:

1. You take the video of traffic that you want to analyze
2. Upload video to our platform
3. Download results and analyze them through our software

2) DataFromSky Real-time offers you HW/SW products for real-time data analysis for traffic monitoring and control (centralized or embedded variant), various application including traffic monitoring, but also crowd management, people counting and tracking in cities, surveillance and security. We have a variant for traffic monitoring from fixed cameras (mounted on highways etc.) or a drone-based realtime solution.

II. DATAFROMSKY ACADEMY PROGRAM

We have decided to make part of our service accessible for students and lecturers for teaching and research purposes (non-financed projects).

General Data From Sky Academy Program Definitions are:

- Provider is RCE systems s.r.o., a company incorporated under the laws of the Czech Republic with its registered seat at Svatopluka Čecha 2008/1d, 612 00 Brno, Id. No.: 021 83 234, recorded in the Commercial Register administered by the Regional Court in Brno under File No. C 80533.
- Educational institution is an organization which carries out educational activity.
- User is person approved by educational institution to use the DataFromSky services defined in.
- Service is advanced traffic analysis of Video, including provision of Results and related services provided by the Provider including provision of software products, if applicable. The Service is divided into (i) DataFromSky Aerial (“DFS AERIAL”) and (ii) DataFromSky Light (“DFS LIGHT”).
- Software is the integrated cloud computing solution for providing the Service, including applications, software, databases, interfaces, associated media, documentation, updates, new releases and other components or materials provided therewith, DFS Viewer and other software related to provision of the Service.
- Academy User Account is account dedicated to DataFromSky ACADEMY program per agreed educational institution. This account is necessary to access the DataFromSky service.
- Credits represents a number of hours of the Video, which are assigned to the account or may be bought and analysed via the Service under valid pricelist.
- Result is an outcome of the automated analysis, in format which shows the analysed Video including the detected trajectories of vehicles or people, count of vehicles and other derived parameters

Benefits of DFS ACADEMY Program:

- One-year membership for educational and training institutions
- Access to DataFromSky AI platform and licence-free software
- 1 000 Credits for Automatic data processing in DFS LIGHT and DFS AERIAL (these Credits can not cover manual georegistration from our side - you can set your own within DFS Viewer, 100% data accuracy and Licence plate detection and has to be purchased according to valid pricelist)
- Access to existing data sets of other institutions within the Program
- Certificate proving participation in the Program
- Cooperation on research projects
- No-special HW required

Our requirements in case you decide to join the Academy Program, are:

- Closer cooperation on research projects and mutual propagation
- DataFromSky AI will be presented as part of lectures to be utilized in student works/thesis
- Minimally 2 public posts connected to DataFromSky AI
- DataFromSky AI can use results from the platform only for internal purposes such as DNN network training or improvement of Service provision
- You can share data sets with DFS ACADEMY program participants (optional)



Fig. 1: DataFromSky Viewer
Source: [1]

DataFromSky Viewer (Fig. 1) is currently supporting UTM and WGS-84 system for localization of objects with precision up to 20 cm and using both Imperial and Metric system. Thanks to the software, that is installed on your laptop, you can analyze and export data and statistics offline at any time you want. DataFromSky service detects objects, their movements, interactions and based on this information you can work with data, information and statistics over raw data from the video. See some of features of the software that all with 98% - 100% accuracy:

- Visualize detected objects and their trajectories within the video processed through DFS Light or DFS Aerial
- Classification of objects up to 16 categories
- Origin-Destination matrix (OD matrix)
- Turning movement counts (TMCs)
- Calculation of headways
- Gaptime, time to follow data
- Safety analysis (time to collision, post encroachment time, heavy braking)
- Current speed, acceleration, deceleration of any object
- Color recognition

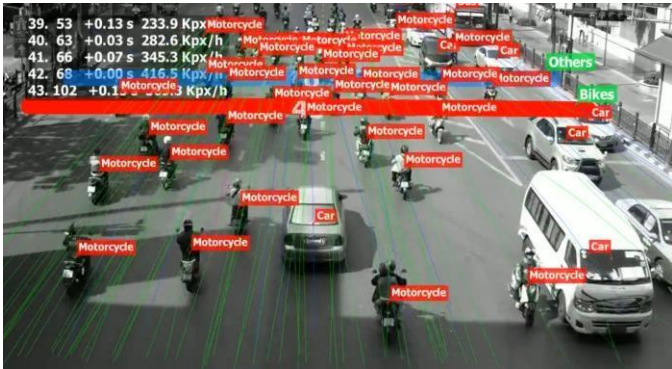


Fig. 2: Easy traffic counting with variety of data types



Fig. 3: Example of complex traffic junction analysis (impossible to do with manual counting)

- Automatic traffic counting with variety of data types (Fig. 2) (incomparable to manual counting especially in complex scenes and non-intrusive compared to induction loops)
- Reliable data even from complex traffic scenes (Fig. 3)
- License plates detection (optional)
- Work with details of each object
- Position of the object within each millisecond of the video
- Interactions of objects within the video - distance measurement
- Travel and occupancy times
- Your own configurable gates for counting that you can change any time you want
- Configurable virtual lanes, traffic regions or action regions
- Capacity evaluation
- Possibility to anonymize your data!
- Possibility to do large-scale surveys - capable to merge footage from 4 drones flying simultaneously
- Possibility to do surveys from long periods with video and tlgx file merging

III. DATAFROMSKY LIGHT VIDEO RECORDING

The DataFromSky Light engine can process data from any video input such as static/handheld consumer camera or footage from an existing CCTV infrastructure. For the best traffic analysis results we recommend the following input video parameters:

- resolution: 1280×720 or more
- bitrate: 5 Mb/s or more
- framerate: 25 fps or more
- min.traffic object size: 32px in one dimension
- continuous video without cuts
- no camera movement

Example of the configuration best suitable for DFS LIGHT analysis:

- elevation of the camera: 10m
- resolution: > HD
- optics FOV: 90°
- angle between the imaging axis and the ground plane: 45°

IV. DATAFROMSKY VIEWER EXPORT DATA IN 5 MINUTES

Results are a small.TLGX file called tracking Log that represents a data package containing information about traffic analysis scene and detected or annotated vehicle trajectory data. Each Tracking Log is closely tied to the video sequence file, as it itself does not contain image data. If you want to view or edit Tracking Log, you have to open it through DataFromSky Viewer with the original video sequence file as well. Download and install DataFromSky Viewer to your computer. It is license-free software, you do not have to pay anything for it! To open the tracking log choose File – Open Tracking Log. Then choose your .TLGX file with the original video you want to analyze as show in Fig. 4.

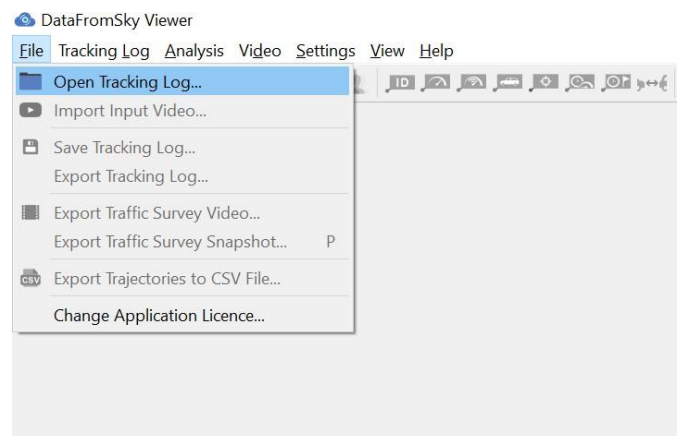


Fig. 4: Example of tracking log file opening

You will be able to see and play the video and see detected objects and trajectories within the video. Now go to Tracking Log – Manage Annotation Configurations.

Clone existing configuration, select new configuration as active and press Edit as shown in Fig. 5. In case you want to set different kinds of scenarios over the video input you can set more than 2 scenarios and save them all to one tracking log file.

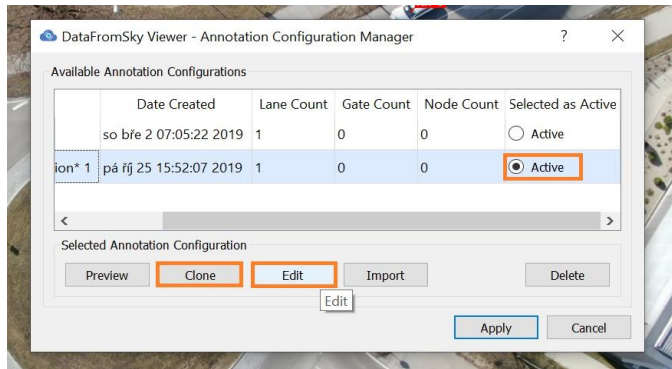


Fig. 5: Example of tracking log file annotation

You are now able to set gates, lanes, traffic regions, action regions, measurement nodes or anonymization regions based on your requirements. Once you set the scenarios that you want to analyze, Confirm Annotation Redefinition and apply the changes to see them in the video. See example how lanes, gates and anonymization region can be set in Fig. 6



Fig. 6: Example roundabout with gates and traffic regions setup

Now if your next question is how to export TMC (turning movement counts)? Get interval data with Turning movement counts

If you are looking for gate statistics in relation to time, you can use Turning Movement Counts export. Based in this report you can get the information about moving objects within gates per 3 defined time periods (Minor, Major and Overall). The length of each period is up to you!

To export data about Turning movements, go to the Analysis menu and choose Export Traffic Analysis to Excel File or you can find Export Traffic Analysis to Excel File button on the Main toolbar.

The exported excel file is consisted from the sheet Overview, Gate Statistics and Turning movements (overall and split by object category):

Overview sheet is divided to two separate parts:

- Survey overview that includes information about the video (date, time and length of video creation) and information about Minor, Major and Overall Period.
- Overall statistics: you can see the overview of objects, number of objects from each category, total distance traveled within the video or Average speed in analyzed video.

Sheet Gate Statistics summarize information such as minimal, maximal and average speed of objects at the moment of passing each gate and you can see count of each object that passed through defined gate as well.

Excel sheet of Turning movements in Fig. 7 – Summary includes gate passing information for each entry and exit gate in each defined minor, major and overall period that you have set. Other sheets display turning movements for each category of object separately (cars, medium vehicles, heavy vehicles, bus, motorcycle, bicycle and pedestrians).

Survey report - Turning movements - Summary

Entry gate - Entry Gate 1					
Period	Exit Gate 4	Exit Gate 3	Exit Gate 2	Exit Gate 1	Total
12:00:00 - 12:00:29 (30 seconds)	1	4	0	0	5
12:00:30 - 12:00:59 (30 seconds)	0	4	1	0	5
12:01:00 - 12:01:29 (30 seconds)	0	3	0	0	3
12:01:30 - 12:01:59 (30 seconds)	1	3	0	0	4
12:02:00 - 12:02:29 (30 seconds)	2	6	0	0	8
12:02:30 - 12:02:59 (30 seconds)	1	0	0	0	1
12:00:00 - 12:02:59 (3 minutes)	5	20	1	0	26
12:03:00 - 12:03:29 (30 seconds)	1	0	0	0	1
12:03:30 - 12:03:59 (30 seconds)	0	9	1	0	10
12:04:00 - 12:04:29 (30 seconds)	0	10	0	0	10
12:04:30 - 12:04:59 (30 seconds)	1	2	0	0	3
12:05:00 - 12:05:01 (1 seconds)	0	0	0	0	0
12:03:00 - 12:05:01 (2 mins 1 sec)	2	21	1	0	24
Total (whole sequence)	7	41	2	0	50

Overview Gate Statistics Turning movements - Summary Turning movements - Car

Fig.7: Example of sheet turning movement summary

V. SAFETY ANALYSIS IN THE DATAFROMSKY VIEWER

Analyze nearby collisions, post encroachment time, heavy braking and other safety data in your video.

Are you designing a new concept of a street or need to identify dangerous situations based on interactions between vehicles? Use our safety analysis that can provide you data about near by collisions, post encroachment time or heavy braking in your video. You can export these data to a .CSV file for further analysis as well.

You can set your own Safety analysis parameters in Analysis – Safety Analysis – Safety Analysis. In the same menu, you can choose the possibility to Show Safety Analysis Conflicts List. This option shows you the list of detected conflicts that you can go through in a video and export data out of it to a .CSV file (in the same menu under Export Safety Analysis to .CSV File).



Fig. 8: Example of nearby collision

Nearby collision as shown in Fig. 8 will detect time to collision in case vehicles would be moving at a constant speed and direction at that moment. You can define which nearby collisions should be listed by setting the limit for time to collision (for example 2 seconds from the collision) or minimal speed difference of both vehicles.

If you work with time to collision you can choose whether you want to identify risky situations for the whole duration of the video or only for a part of it, type of the vehicles that you want to include to the analysis and two models for the movement prediction of vehicles:

- Speed Vector – This is a simple calculation where the movement of the vehicle is considered straight forward. For this reason, the calculation of collisions in a curve is not entirely accurate, but the calculation is less demanding.
- Ackerman Steer Model – This is a more precisely defined vehicle model, the calculation is based on the angle of wheels, but for this reason, the calculation is more demanding and takes more time.

Once you confirm your settings, conflict list appears. You can go through each Conflict and play the video to see the whole scene. Once you click to TCC Progression: Show, graph of Time to Collision in relation to Video Time shows.

How to anonymize data in the video?

Do you want to present your data, but you can recognize people, licence-plates or other private information in the video? Do not worry, we are prepared for that! Use the possibility to anonymize certain area in the scene view by creating anonymization region. Creation of the anonymization region is similar to creation of action region.

Great news is that anonymization is copying stabilization of the frame. In case your camera is moving, anonymization region is moving with it, so your objects are still hidden!

To set the Anonymization region, go to Tracking log – Manage Annotation Configuration and edit tracking log, where you want to apply the anonymization. Click to “Adds Anonymization Region defining area which should be anonymize.” And start creating polygon that you want to make blurry. You can set Degree of blur in the Selected

Annotation column. If you want to you can anonymize everything outside of current view as well!

DataFromSky TrafficSurveyViewer also has many visualization options including trajectory coloring by category, speed, acceleration or direction. Heat maps such as speed heatmap in Fig. 9, Grid maps and color-coded Origin-Destination pictures can be made easily in couple of clicks.



Fig. 9: Example visualization - speed heat map

VI. CONCLUSION AND RECOMMENDATIONS

DataFromSky Academy program is a great and versatile tool for researchers in traffic allowing them to do a great variety of research with highly accurate input data that is easy to get thanks to AI. Together with other tools such as scripting or excel the data can further be processed into the desired form. There are 3 main benefits of the Academy programme:

1. it is free
2. it is given to any university that signs the agreement with simple promotion related tasks
3. there is no other similar software that would provide the same range and quality of data.

One of the downsides can be that getting footage from CCTV cameras from cities for free is hard to obtain for light analysis and shooting drone footage for aerial analysis has additional costs that the researchers need to cover themselves. Overall DataFromSky Academy provides the ideal tools any traffic researchers can wish for as long as they have own ability or funds to obtain drone footage for the video analysis.

REFERENCES

- [1] <https://ai.datafromsky.com/light>
- [2] <https://ai.datafromsky.com/aerial>