

Data-Driven emulator: Installation and execution guide

Hotfix 2.0

- Solved a bug that generate the same csv files for the three directions for each parameter.
- Now the emulator requires MATLAB Runtime 9.9 (R2020b) instead version 9.8 (R2020a).

Introduction

A data-driven emulator of head impacts kinematic, based on on-field measured kinematic data from contact sports (American football, mixed martial arts and boxing).

Related research: <https://arxiv.org/abs/2004.12979>

The generated kinematic data will be composed by 3D linear acceleration, angular velocity and angular acceleration with time length of 100 ms and sample frequency of 1000Hz.

Before Installation

In order to run the stand-alone program you need to install MATLAB Runtime R2020b (9.9). You can download it from <https://www.mathworks.com/products/compiler/matlab-runtime.html>.

INPUT and OUTPUT of the program

INPUT

The data-driven emulator requires INPUT parameters from the user. Those parameters are:

- **Number of required data (n):** The number of linear acceleration, angular velocity and angular acceleration impulses desired to be generated.
- **Number of basis modes (k):** The number of modes used for generating data. The maximum modes depends on the parameter: For angular velocity is 15, for angular acceleration is 21 and for linear acceleration is 29.

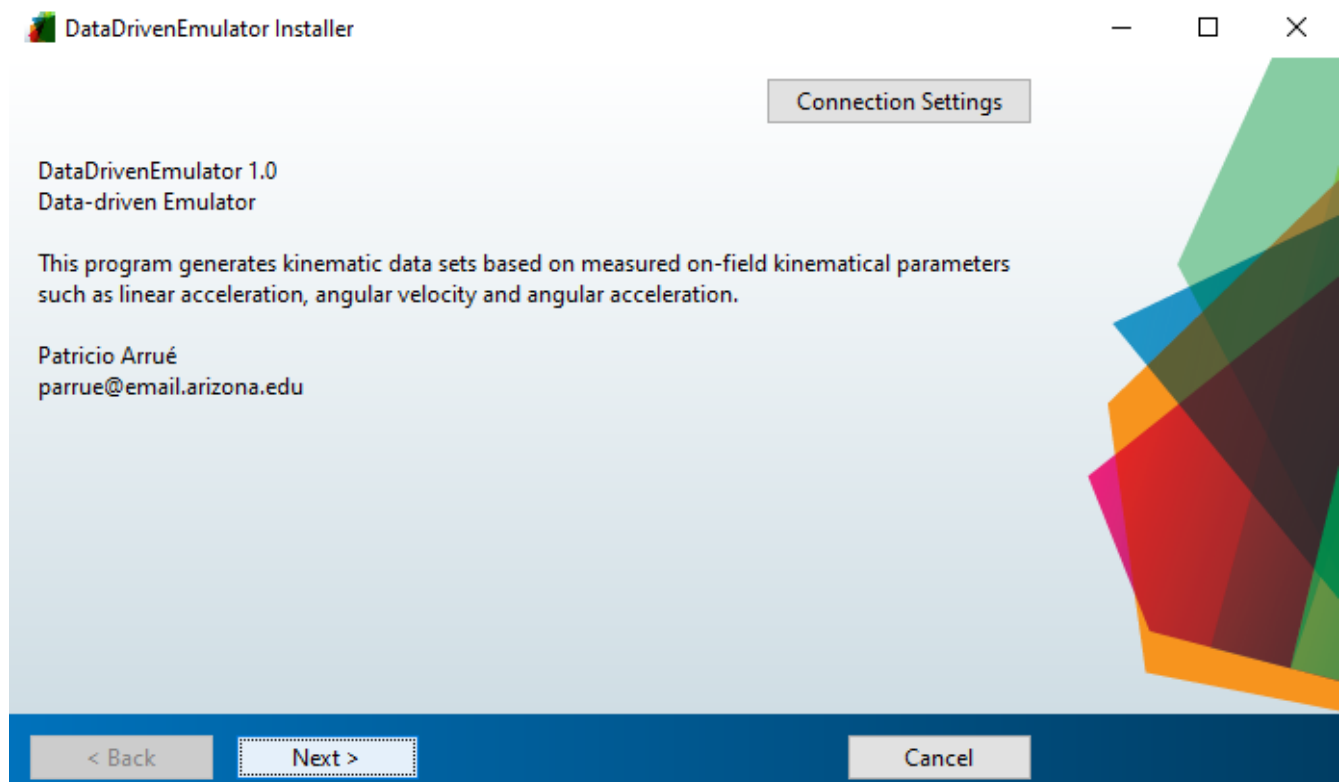
OUTPUT

The Output will be a set of 9 .csv files. Each one contains a matrix of 100xn in which each column represent a single impulse of 100ms of duration, with the following nomenclature:

- LaAP: Linear acceleration Antero-Posterior direction.
- LaLat: Linear acceleration Lateral direction.
- LaIS: Linear acceleration Inferior-Superior direction.
- oCor: Angular velocity Coronal plane.
- oSag: Angular velocity Sagittal plane.
- oAx: Angular velocity Axial plane.
- aCor: Angular acceleration Coronal plane.
- aSag: Angular acceleration Sagittal plane.
- aAx: Angular acceleration Axial plane.

Installation guideline

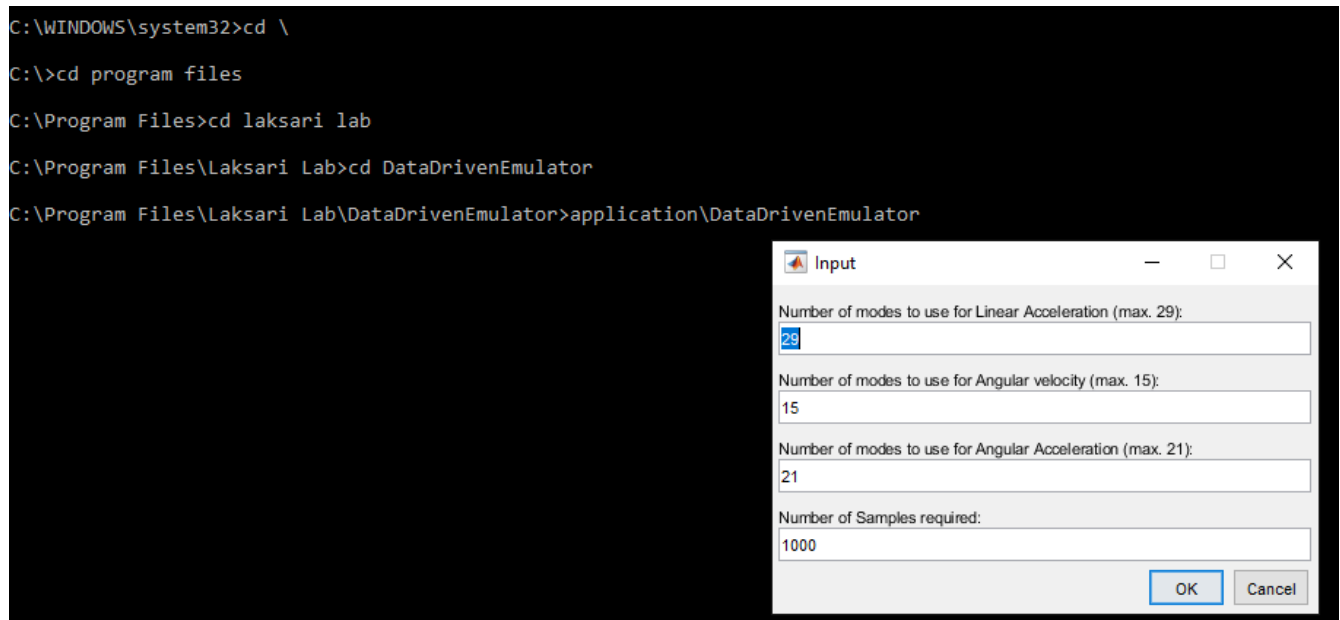
After the installation of MATLAB Runtime you can install the Data-driven Emulator. Please download the executable file, open it and follow the installation instructions.



Running the program

Windows

- 1) Open CMD as administrator (This step is important).
- 2) Go to the folder path where the program was installed. Use “cd \” for going to the root folder of the respective hard disk, “dir” to see folders of the current path and “cd ”**Name of folder**” to navigate.
- 3) Once when you are in the installation folder use the following command to run the program: “application\DataDrivenEmulator”.



Mac OS X

- 1) You must set the \$DYLD_LIBRARY_PATH\$ environment variable in the command window for the standalone application to work as follows:
\$export DYLD_LIBRARY_PATH = MCR_ROOT/v92/runtime/maci64:MCR_ROOT/v92/sys/os/maci64:MCR_ROOT/v92/bin/maci64
- 2) Use the following command for running the program: “./NAMEPROGRAM.app/Contents/MacOS/DataDrivenEmulator”.

Linux

Open the terminal in the installation folder and use this command: “.\DataDrivenEmulator”

Results

The head impacts kinematic data stored in csv files will be generated in the installation folder.

LaLat.csv - OpenOffice Calc

Archivo Editar Ver Insertar Formato Herramientas Datos Ventana Ayuda

Arial 10 N C S

A1 3.37411588372983

	A	B	C	D	E
1	3.37411588372983	-3.70095230434083	2.79655547172977	-1.81115994218347	1.62141171165573
2	4.05304946791755	-3.39656190875122	2.55397143019337	-1.18761490445786	0.578992084469111
3	4.85341608647303	-3.06140467050583	2.23859353886065	-1.24214087972694	0.180169561847767
4	5.69944451811185	-2.58987295126254	1.7531867717372	-1.91569153499666	0.470138276007317
5	6.27602726236664	-2.0498224932807	1.17908130652906	-2.68728961023132	1.03709848653981
6	6.060353263514	-1.64721335849791	0.698936929197962	-3.13373096675882	1.44574203602621
7	4.74396121666629	-1.64594859573139	0.483351365031728	-2.80807134468692	1.50667459453241
8	2.52301915091973	-2.28132748975674	0.547089329622992	-1.32333107172129	1.17921841277424
9	0.124719482527816	-3.41625061665661	0.811992757348994	1.23812063561447	0.586155103726316
10	-1.27627255439915	-4.05905836271819	1.23558978166673	4.0443213598509	0.181930161051332
11	-0.338303992384194	-2.61254248539824	1.67903189874718	5.87994377605303	0.652981802331779
12	3.49517698353092	1.59123116730658	1.73462660738565	5.77524275361345	2.2271169666898
13	8.60844980512497	6.6660809222431	1.12165774056791	3.18566841296418	4.22261470809601
14	11.8631370035589	8.87892710205918	0.0796503390533042	-0.879782785399099	5.47481373473535
15	11.401439990267	6.59035514348857	-0.645622933716057	-4.30062020422222	5.60934657250464
16	8.0438662354082	2.42989044557629	-0.189167268986793	-6.3019287485642	5.5999911701142
17	4.1492107603103	-0.0606158523537029	1.6721216510534	-6.91923097403879	6.59027557464984
18	1.9056174532638	0.0261674463184536	4.2284371783501	-5.62518350118295	8.55307149057351
19	1.63240348529876	1.58113151572666	6.47254774880576	-3.10476378424857	10.5503998705144
20	1.84456346353825	3.27026011158048	8.11187711649688	-0.932163427969778	11.5840336952971
21	1.18409460481999	4.20405596852528	9.72127946193662	0.789342321332375	10.9491927038127
22	-0.695565739219602	4.20742389624085	11.8328041668776	2.47405746897027	8.55602294052358
23	-3.14435533713261	3.92070603764428	13.9576687184845	3.75373608958298	5.08909383258807