



OpenDIEL Software Development and GUI

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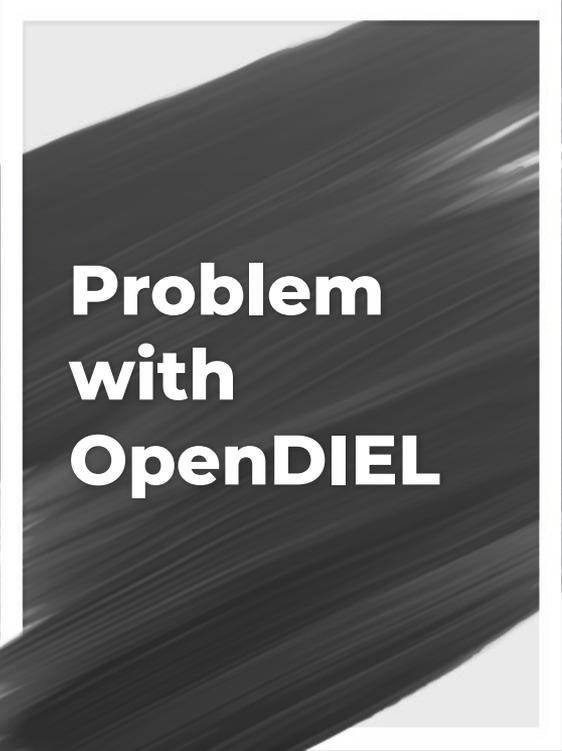


What is OpenDIEL?

The open Distributive Interoperable Executive Library (openDIEL) is a parallel workflow framework with built in communication and scalability across many nodes.

Put Simply

It can be thought of as a way of launching applications in an organized manner.



Problem with OpenDIEL

Process can be tedious while working on command line. Not entirely user friendly.

Is there a way to make running modules using openDIEL easier?

GUI

What is a GUI?

Short for graphical user interface, a GUI is an interface that uses icons or other visual indicators to interact with electronic devices, rather than only text via a command line.



Tkinter

Tkinter is a python GUI programming toolkit. Tkinter is included with python and is the most commonly used python GUI programming toolkit. Tkinter is easy to learn and extremely accessible. Must be familiar with python.



tk

Annual Rate:

Number of Payments:

Loan Principle:

Monthly Payment:

Remaining Loan:

Final Balance Monthly Payment Quit

Tkinter Designer - cdhigh@sohu.com - v1.6.1 [Project1]

File(F) Options(O) Tools(T) Languages(L)

Refresh Forms (R) Generate Code (G) Copy to Clipboard (C) Save to File (E) Quit (Q)

Form1	Property	Value
top (Form)	<input checked="" type="checkbox"/> geometry	850x530
Label1 (Label)	<input checked="" type="checkbox"/> title	tkinter-designer cdhigh@sohu.com
Text1 (TextBox)	<input checked="" type="checkbox"/> left	0
Command1 (CommandBut	<input checked="" type="checkbox"/> top	0
Frame1 (Frame)	<input checked="" type="checkbox"/> resizable	1
Picture1 (PictureBox)	<input checked="" type="checkbox"/> windowstate	'normal'
Check1 (CheckBox)	<input type="checkbox"/> topmost	
Option1 (OptionButtc	<input type="checkbox"/> alpha	
Combo1 (ComboBox)	<input checked="" type="checkbox"/> position	Default
List1 (ListBox)	<input checked="" type="checkbox"/> icon	
HScroll1 (HScrollBar)	<input checked="" type="checkbox"/> iconembedding	1
VScroll1 (VScrollBar)	<input type="checkbox"/> bindcommand	
Line1 (Line)	<input type="checkbox"/> protocol	
TabStrip1 (TabStrip)		

```

geometry
Geometry of Form
(width x height),
unit is pixel.
  
```

```

#!/usr/bin/env python
# -*- coding:utf-8 -*-

import os, sys
if sys.version_info[0] == 2:
    from Tkinter import *
    from tkFont import Font
    from ttk import *
    #Usage:showinfo/warning/err
    from tkMessageBox import *
    #Usage:FileDialog.askopen
    #import tkFileDialog
    #import tkSimpleDialog
else: #Python 3.x
    from tkinter import *
    from tkinter.font import Fo
    from tkinter.ttk import *
    from tkinter.messagebox imp
    #import tkinter.filedialog
    #import tkinter.simpledialog

class Application ui(Frame):
    #The class will create all
    def __init__(self, master=None):
        Frame.__init__(self, ma
  
```

Mie Solver

Model Solver Cross Section Results

Geometry

- Solid Sphere
- Core-Shell
- Cylinder

Welcome | Module Specification | Workflow | Machine Learning | LIGGGHTS | Save | Launch |

New Module

Module Type: Managed Automatic
 Library Type: Static Dynamic
 Module Name:
 Path To Library:
 Browse...
 Path to include:
 Browse...
 Input Arguments:
 Boundary Points:
 Size:
 Copies:
 Processes Per C:
 Threads Per Proc:
 Number of GPUs:
 Split Directory:

Saved Modules

onartest

Load Existing Modules

Preconfigured Modules:

-
-
-
-
-
-
-
-

Welcome | Module Specification | Workflow | Machine Learning | LIGGGHTS | Save | Launch |

Available Modules

-
-
-
-
-
-

Available Groups

-
-

New Group

Group Name:
 Modules to run:
 Iterations:
 Dependencies:

Welcome | Module Specification | Workflow | Machine Learning | LIGGGHTS | Save | Launch |

CFG File Name:

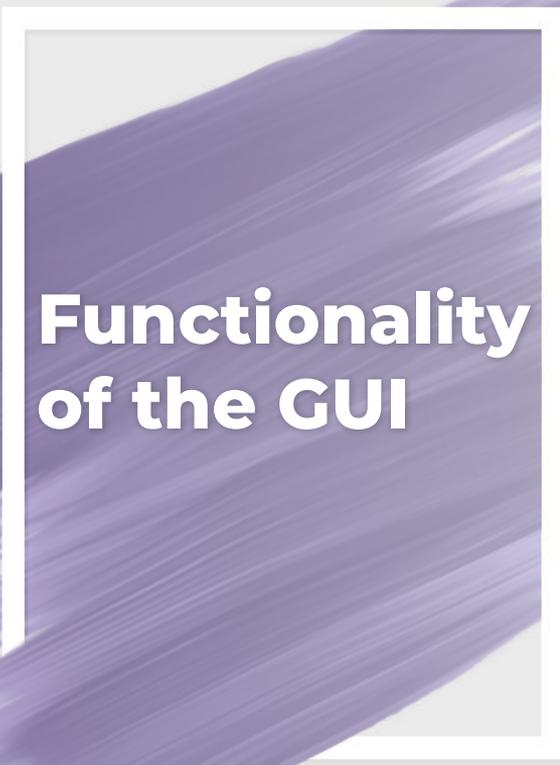
```

loop_space_size = 0;
range_of_GPU = 1;
modules = {
  MODULE-0 = {
    function = "MODULE-1";
    gpu = {
      ("../hello.exe",)
    };
    size = 5;
    libname = "static";
  };
  MODULE-1 = {
    function = "MODULE-1";
    gpu = {
      ("../hello.exe",)
    };
    size = 5;
    libname = "static";
  };
  MODULE-2 = {
    function = "MODULE-2";
    gpu = {
      ("../hello.exe",)
    };
  };
};
  
```

Welcome | Module Specification | Workflow | Machine Learning | LIGGGHTS | Save | Launch |

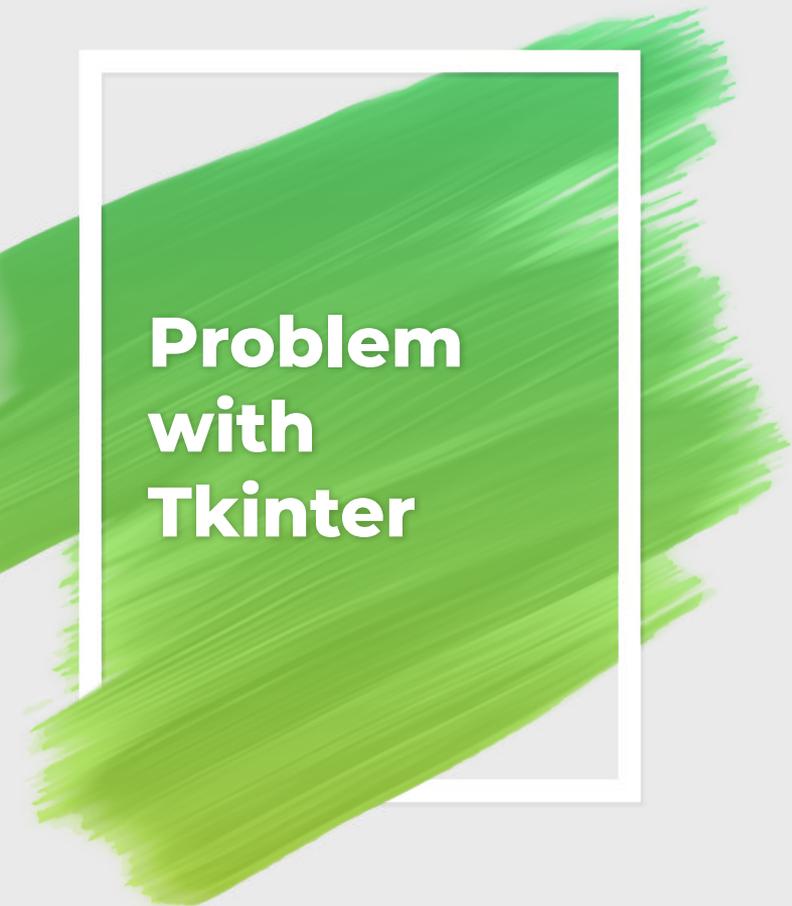
Defined Workflow

Output Directory:
 Output Directory Location:



Functionality of the GUI

- Worked is saved using a saved data class that holds all information and is passed to every tab within the GUI.
- Modules are loaded through parsing of configuration file new modules are created
- Groups are created and workflow is saved
- Configuration file is created
- Number of processes is determined and mpirun command is called

A large, vibrant green brushstroke graphic that sweeps across the left side of the slide, partially overlapping a white rectangular frame.

Problem with Tkinter

Stylistically, Tkinter is not the most visually appealing and laying out widgets in an attractive manner can prove to be difficult.

Some task are also not easy to achieve using tkinter



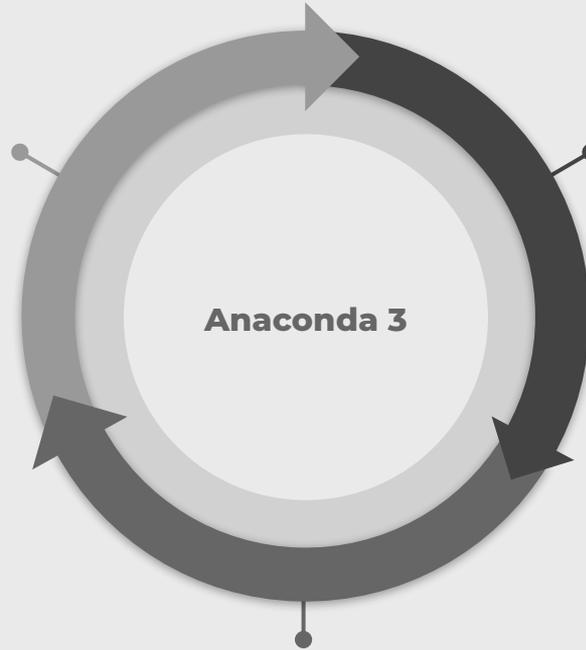
KIVY

Cross Platform Open Source Rapid development

Fresh Flash Flexible Focused Fun Free

How to Install Kivy

Install Anaconda 3
Check if it is install
by typing "Python
--version"



Make a virtual
environment
- Type "conda
create -n 'name' "

Install Kivy
-Open terminal
- type "conda
install -n 'name' -c
conda-forge kivy"



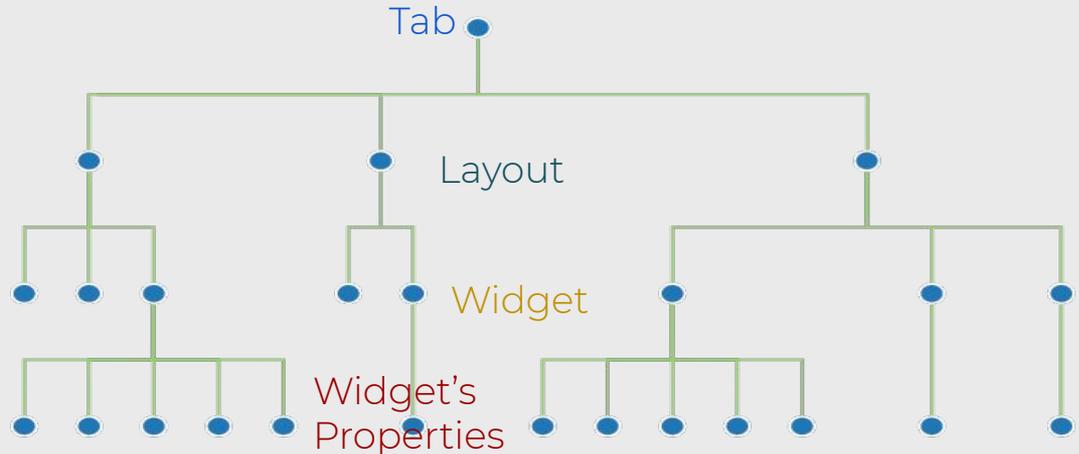
Benefit of Kivy

- Mobile app development
- Automatically format widgets to most appealing design
- Visually appealing
- Good cooperation with different OS
- Interface Logic Separation

What Kivy files look like

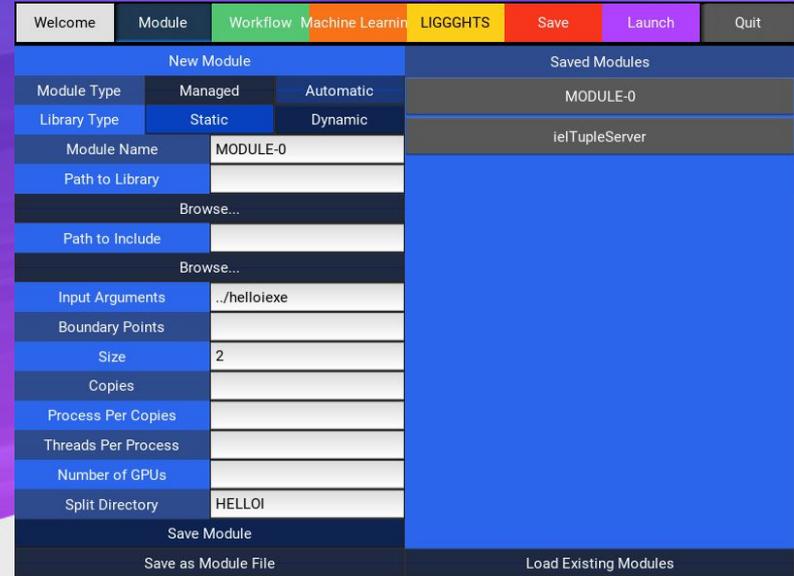
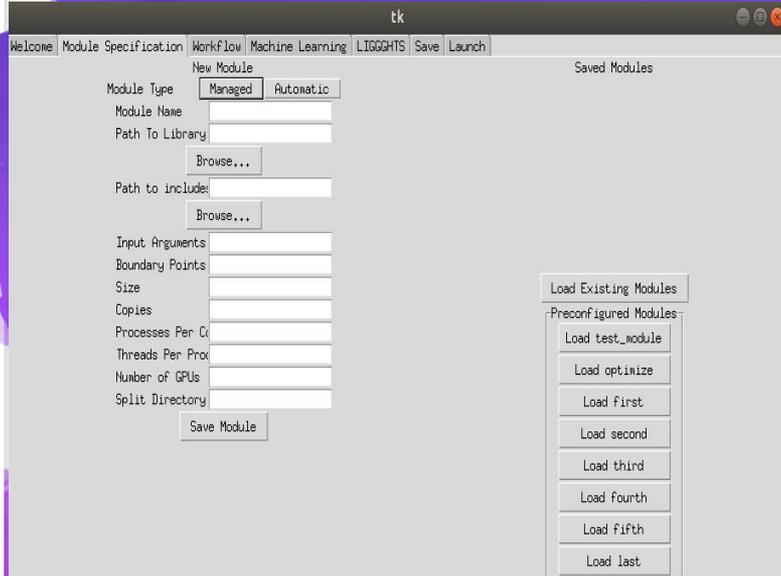
- Tree Diagram

```
1 |kivy 1.1.0
2
3 Root:
4   text_input: text_input
5
6   BoxLayout:
7     orientation: 'vertical'
8     BoxLayout:
9       size_hint_y: None
10      height: 30
11      Button:
12        text: 'Load'
13        on_release: root.show_load()
14      Button:
15        text: 'Save'
16        on_release: root.show_save()
17
18   BoxLayout:
19     TextInput:
20       id: text_input
21       text: ''
22
23     RstDocument:
24       text: text_input.text
25       show_errors: True
26
27 <LoadDialog>:
28   BoxLayout:
29     size: root.size
30     pos: root.pos
31     orientation: 'vertical'
32     FileChooserIconView:
33       id: filechooser
34
35   BoxLayout:
36     size_hint_y: None
37     height: 30
38     Button:
39       text: "Cancel"
40       on_release: root.cancel()
41
42     Button:
43       text: "Load"
44       on_release: root.load(filechooser.path, filechooser.selection)
45
46 <SaveDialog>:
47   text_input: text_input
48   BoxLayout:
```



Tkinter

Kivy



GUI

Welcome	Module	Workflow	Machine Learning	LIGGGHTS	Save	Launch	Quit	Welcome	Module	Workflow	Machine Learning	LIGGGHTS	Save	Launch	Quit				
New Module				Saved Modules				Available Groups				New Group							
Module Type	Managed	Automatic		MODULE-0				tuple_group	Edit	Add Dependency									
Library Type	Static	Dynamic		ielTupleServer				g1	Edit	Add Dependency	Group Name	tuple_group							
Module Name	MODULE-0											Modules to run	ielTupleServer.MODULE-0						
Path to Library	Browse...											Iterations	1						
Path to Include	Browse...											Dependencies							
Input Arguments	.../helloixe											Available Modules							
Boundary Points												MODULE-0							
Size	2											ielTupleServer							
Copies												Save Group							
Process Per Copies																			
Threads Per Process																			
Number of GPUs																			
Split Directory	HELLOI																		
Save Module				Load Existing Modules								Load Workflow from File							
Save as Module File				Load Existing Modules															
Welcome	Module	Workflow	Machine Learning	LIGGGHTS	Save	Launch	Quit	Welcome	Module	Workflow	Machine Learning	LIGGGHTS	Save	Launch	Quit				
CFG File Name				test.cfg				Current Driver Path				Defined Workflow							
Create Configuration File								Change Driver Path				Output Directory Name							
												Output Directory Location							
								Display Attribute Info				Launch Job							
<pre>tuple_space_size = 1; number_of_gpu = 1; modules = { MODULE-0 = { size = 2; splitdir = "HELLOI"; function = "MODULE-0"; args = (".../helloixe"); libtype = "static"; }; ielTupleServer = { function = "ielTupleServer"; args = (); libtype = "static"; }; };</pre>								<pre>Current Job: /home/user1/openssl-gui-2019/KIVY/test.cfg copes: 1 libtype: static size: 1 args: python tmp.py function: MODULE-0 module_type: automatic</pre>				<pre>Initializing the executive... Initializing the executive... Initializing the executive... Initialized module 0 with 1 cores(s) and 1 copy/copies. Initialized module 1 with 1 cores(s) and 1 copy/copies. Warning: Unused rank [EL-Module-Start - Rank[0] Name[ielTupleServer]] 0: Server Refined: 0 requests [EL-Module-End - Rank[0] Name[ielTupleServer] Status[0]] Module Exit Status: No error [EL-Module-Start - Rank[1] Name[MODULE-0]] Hello Omar [EL-Module-End - Rank[1] Name[MODULE-0] Status[0]] Module Exit Status: No error</pre>				<pre>Most Life Time: Process 1 0.000304 seconds (65.223379%). Earliest End Time: Process 2 time = 0.000207 seconds. Latest End Time: Process 1 time = 0.041062 seconds.</pre>			

DEMO Time



APPLICATIONS OF OpenDIEL

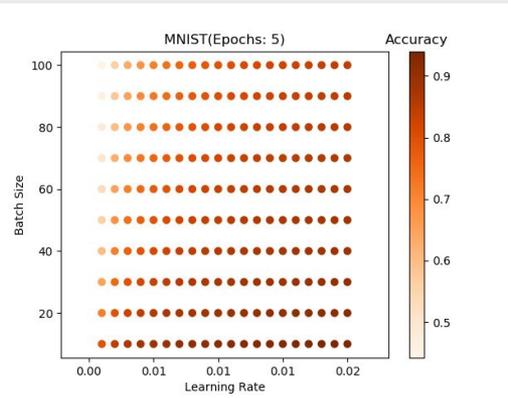
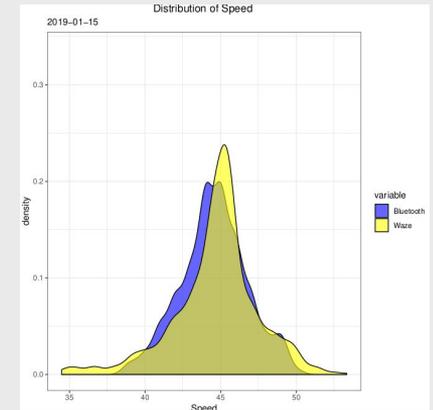
Grid Engine with MagmaDNN

Search a hyperparameter space with a neural network.

With features such as:

- Freeing unnecessary resources
- Loading and resuming a previous search
- Add new Search methods and Trainee types
- Live visualization during training

Traffic Data Analytics



Two Methods of Interface

The Machine Learning Grid Engine

Simple Grid

Modify a configuration file to change the search space by resolution of the space, area of the space, and parameter type.

```
parameters =
(
# For learning rate, this ends up starting at 0.01, ends at
# .05, and will increment in .01 steps. So, this will end up
# trying the values 0.01, 0.02, ..., 0.05
{
  name = "learning_rate";
  # can specify either continuous or discrete parameter
  type = "continuous";
  # start is the starting value in the search for this parameter
  start = 0.01;
  # end is the ending value in the search for this parameter
  end = 0.10;
  # step_size is the increment to change the parameter by in
  # each part of the search
  step_size = 0.01;
},
{
  name = "epochs";
  type = "discrete";
  start = 1.0;
  end = 10.0;
  step_size = 1.0;
},
{
  name = "batch_size";
  type = "discrete";
  start = 10.0;
  end = 100.0;
  step_size = 10.0;
}
);
```

Advanced

Add your own search method such as PBT or LCM by introducing a new search class into the c++ code.

```
void grid_search_method::trainer_loop()
{
  vector< grid_layer > layers;
  vector< grid_param > parameters;
  /*
   * do some modification of the hyperparameters
   */
  for (size_t i = 0; i < n_trainees; i++) {
    send_hyperparameters(i, &parameters, &layers);
  }
  /*get the metrics */
  for (size_t i = 0; i < n_trainees; i++) {
    trainee_metric t;
    recv_metrics(i, &t);
  }
  /*send the trainees the done signal */
  for (size_t i = 0; i < n_trainees; i++) {
    send_hyperparameters(i, NULL, NULL);
  }
}

void grid_search_method::trainee_loop()
{
  t->recv_hyperparameters();
  t->train();
  t->send_metrics();
}
```



FUTURE WORK

GUI tab: Grid Engine

A new interface to the Grid Engine with live preview of training process

GUI tab: Examples

Add each OpenDIEL Example to the GUI for easy testing and teaching

GUI tab: Liggghts

Get the old GUI code for Liggghts working in Kivy

GUI tab: Applications

Add each OpenDIEL Application to the GUI

Grid Engine Trainee Types

Add more trainee types such as Tensorflow

Grid Engine Search Methods

Add more search methods to the grid engine such as Population Based Training with configuration file interface



THANK YOU!

Any questions?