Exercise objective:

To predict fault's location using the "Seismic – Pre-trained models - Unet 3D Fault Predictor" tool which is part of the machine learning plugin. In this exercise, we want to predict faults location.

Seismic data Preparation

Seismic need to be available in the survey. If not, **import** seismic, and interpret some "key fault" locations or use an existing trained model.

Workflow:

- 1. Open the Machine Learning Control Center with the icon.
- 2. Click on "Pre-trained Models".
- **3. Select** the "Unet 3D Fault Predictor" and **Press** Go.



- 4. The *"Apply Unet 3D Fault Predictor"* window pops up.
- **5. Select** *Input Cube* (e.g. 4 *Dip steered median filter*).
- 6. Specify a new name for the "Output Fault Volume to Cube" (e.g. 'Fault_Prob_Unet).
 If not enough GPU memory, use CPU or crop the Volume in subselection.
- 7. Press Run.
- When the processing finish, Press button O to close the Progress Viewer window.

	Predict u	sing 🔿 2D data	a 🖲 3D data						
nput for 'Seisr	nic Data' 🔀	4 Dip stee	ered median filte	er	~	Select			
	Apply Overlap	(%) inl: 10 🖨	crl: 10 🖨 z:	10 🖨 M	erge Mod	e Blend		\sim	
	Volumo subsele	tion 100/200-	750/1250 (462)	camples)		Coloct			
	volume subsciel	100/300	750/1250 (405 %	samplesj		Select			
C	output 'Fault Volu	ime' Fault_Pro	b_Unet		~[😑 Select) <u>(</u>	BVS	\sim
	Predict u	sing 🖲 GPU	⊖ CPU						
	Execute in Ba	tch 🔅 Optior	IS						
						Ru		😢 Clos	• ?
								-	
Progress	/iewer						-		×
\mathbf{O}	₽ ?								
Processin									
Process I dTect V6. Process: Started: Process: Finished:	g on: dgb19 D: 51928 6 'Deep Learni Fri 13 Mar 2 Applying De : 'Deep Learni Fri 13 Mar	ng Applier' 020, 13:45: ep Learning 100% ng Applier' 2020, 13:52	35 Network :17						
Process I dTect V6. Process: Started: Process: Finished: End of pro-	g on: dgb19 D: 51928 6 'Deep Learni Fri 13 Mar 2 Applying De : 'Deep Learni Fri 13 Mar	ng Applier' 020, 13:45: ep Learning ng Applier' 2020, 13:52 Learning A	35 Network :17 pplier'						
Process I dTect V6. Process: Started: Process: Finished: End of pr Finished 1	g on: dgb19 D: 51928 6 'Deep Learni Fri 13 Mar 2 Applying De : 'Deep Learni Fri 13 Mar occess: 'Deep batch proces	ng Applier' 020, 13:45: ep Learning ng Applier' 2020, 13:52 Learning A sing.	35 Network :17 pplier'						

QC the output fault probability results on the In-line 680.

9. Right Mouse click on In-line > Add and select Data > Store. Select the created Fault Probability cube (e.g. Fault_Prob_Unet_In680), and then Press OK.

10. Type in the Inline field: 680, and then Press Enter.

The same way, add to the display, the existing Thinned likelihood probability display.

11. Right-Click on Inline 680 > Add > Attribute >Stored. Select the existing thinned fault likelihood (e.g. Fault_Likelihood_Thinned_from_DSMF_seis), and Press OK.

🛞 Select	— 🗆	\times
Select first laye	r	
	Filter *	
Stored	Connect_Vol_AL	^
O Steering	Fault_Likelihood_Thinned_from_DSMF_sei	s
 Attributes 	Fault_Prob_Unet_InI680_AI	
si c	POrosity_AL Prob Vol AL	
		•
	Cancel 🕑 F	lelp
	👫 🚃 In-lin <mark>e 680 🗧</mark> Step 1	-
Tree scene	e 1	8
Elements		Color
Scene	1	
🗸 🌒 In-li	ne	
~ 🖂	680	
	✓ Fault Prob Unet InI680	
÷.		
🛞 Select	- 0	×
Select Layer 2		
	Filter *	
Stored	Colored inversion 2dol 15Hz	•
	Colored_inversion_AL	
O Attributor	Confidence_tst1	
	Connect_Vol_AL	
SEG	Fault Prob Onet AL	seis
Na l		•
	OK Scancel	PHelp
Tree scene 1	OK Cancel	PHelp
Tree scene 1 Elements	OK Cancel	? Help P Color
Tree scene 1 Elements Scene 1	OK Cancel	PHelp
Tree scene 1 Elements Scene 1 Y 🌒 In-line	OK Scancel	P Help
Tree scene 1 Elements Scene 1 Y In-line V 1680	OK Cancel	PHelp
Tree scene 1 Elements Scene 1 ✓ ♥ In-line ✓ ☑ 680	OK Cancel	PHelp

12. Display the predicted fault probability, and **Compare** with the thinned fault likelihood.

<u>Note:</u>

The thinned fault likelihood, contains more small faults and noise. Whereas the predicted fault probability, contains more faults information and less noise.

The predicted fault probability is un-thinned. To be able to make a fair comparison with the thinned fault likelihood, a thinning needs to be applied to the predicted fault probability.

In the next steps we will apply the thinning.

Predicted fault probability (un-thinned)



Thinned fault likelihood



The next step, is to apply a thinning to the predicted fault probability.

- 13. Select: faults and fractures > 3D icon
- The Faults and Fractures 3D Control Center window pops up. Select Filters > Skeletonization.
- **15. Press** Go.

📆 > 🛼 🛞 (//)	💐 🌒 🛃 🍣 👫 🎵 😭					
💼 Faults and Fractures 3D Co	ontrol Center — 🗆 🗙					
Attributes	Available Filters Dip-steered Median Filter Fault Enhancement Filter Ridge Enhancement Filter Edge-Preserving Smoother					
Filters	Skeletonization					
Planes						
Tools	Go					
	Close 🕜 Help					

- 16. The Volume Skeletonization window pops up.
- 17. Set the parameters as specified in the window:
 - a. Volume subselection: Inline range = 680
 - b. Threshold: 0.5
 - c. Type a new name for the 'Output Cube" e.g. Thinned_ft_prob_Unet_I680_threshold.5

18. Press Run.

19. The Progress Viewer window pops up.Once the computation is done, **Press**Close icon.



- 20. Display: the new thinned predicted fault probability. Right mouse click on the Inline 680 > Add > Attributes. Select the new thinned predicted fault probability (e.g Thinned_ft_prob_Unet_I680_threshold.5).
- **21.** Compare with the existing thinned fault likelihood.

Note that the thinned fault likelihood contains small-scale faults and noise, whereas the thinned predicted fault probability outputs more continuous faults information and less noise.

Thinned predicted fault probability



Thinned fault likelihood

