FIG Joint Land Administration Conference

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TOWARDS A PORTUGAL'S LADM-VM COUNTRY PROFILE: CONCEPTUAL INTEGRATION OF 3D VARIABLES AND DEEP LEARNING FOR RURAL PROPERTY VALUATION

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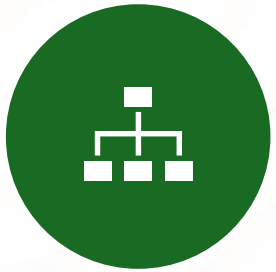
CONTEXTUALISATION

No geometry cadastre (2D) for all rural properties in Portugal

Low tax asset value (VPT) of rural land. Based on land income and, property tax is 0.8% of this value.

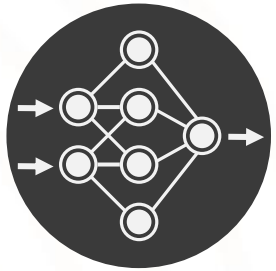
Full representation of both, physical + legal object



Land Administration Domain Model – Valuation Information Model

OBJECTIVES

3D Cadastre

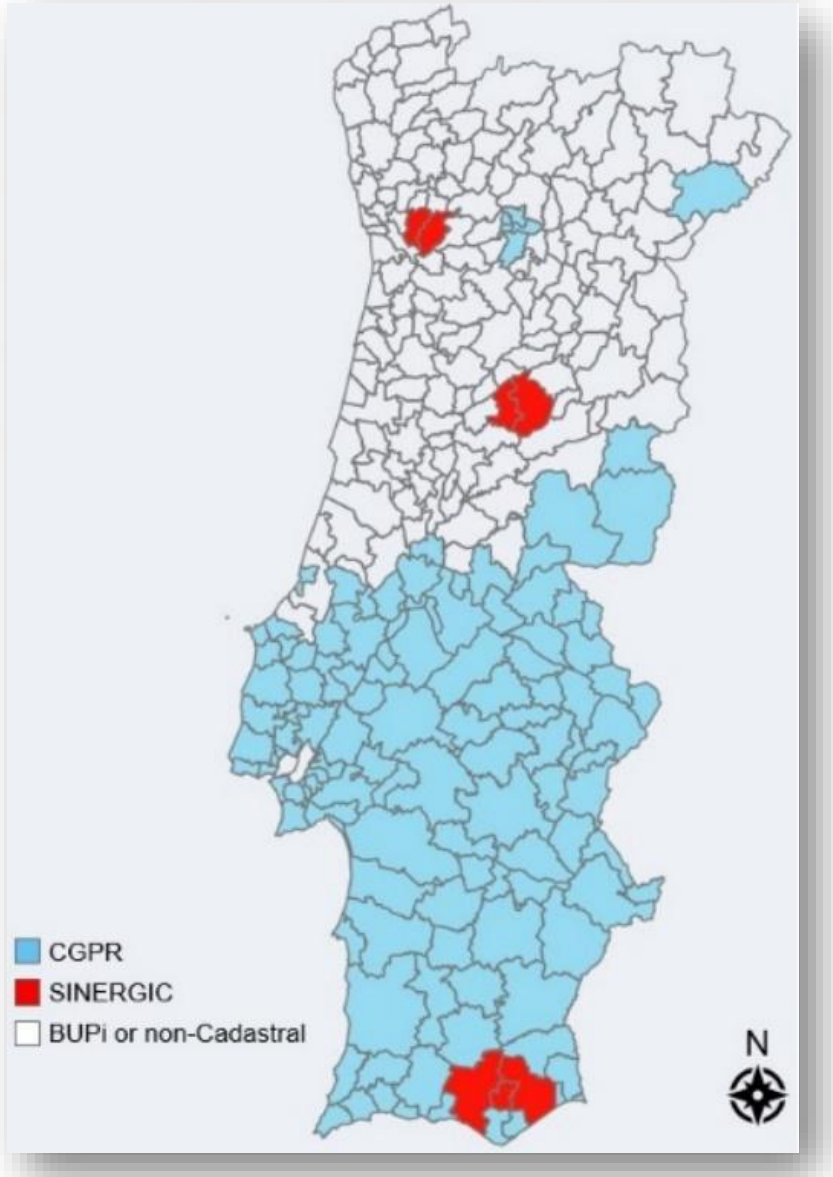


Estimate the VPT based-on DL techniques

Web3DGIS prototype

THE LAND ADMINISTRATION SYSTEM IN PORTUGAL

- Geometric Cadastre of Rural Property (*Cadastro Geométrico da Propriedade Rústica* – CGPR) - 1926
- National System for the Management and Use of Cadastral Information (*Sistema Nacional de Exploração e Gestão de Informação Cadastral* – SINERGIC) implemented between 2006 and 2020
- Simplified 2D cadastral system for rural properties (*Balcão Único do Prédio* – BUPi), established in 2017
- Legal Regime of the Cadastre (*Regime Jurídico do Cadastro Predial* – RJCP), established in 2023



METHODOLOGY

LADM_VM
(Based on Kalogianni et al, 2021 suggestions)

- Problem identification
- Analysis of current LAS & taxation practices
- Identification of stakeholders and data sources
- Mapping LAS classes with LADM-VM classes

Deep Learning

- Literature review
- Identification of variables: (both, independent and dependent)
- Selection of DL architectures
- Linking LADM-VM with DL

DL-BASED MODEL FOR TAX ASSET VALUE ESTIMATION

Independent variables

Variable groups	Variables
3D Variables	• Volume Property
	• Solar potential estimation
	• Shadow estimation
	• Energy demand
	• Water volume demand
	• Water potential estimation
	• Visibility analysis
	• Noise propagation
	• Elevation
	• Slope Angle, Aspect and Position
	• Terrain Ruggedness Index
Biophysical Characteristics	• pH
	• Soil: texture, fertility, salinity, erosion, thickness
	• Ombrothermic index
	• Thermicity indexes

⋮

Dependent variables

Forest profitability

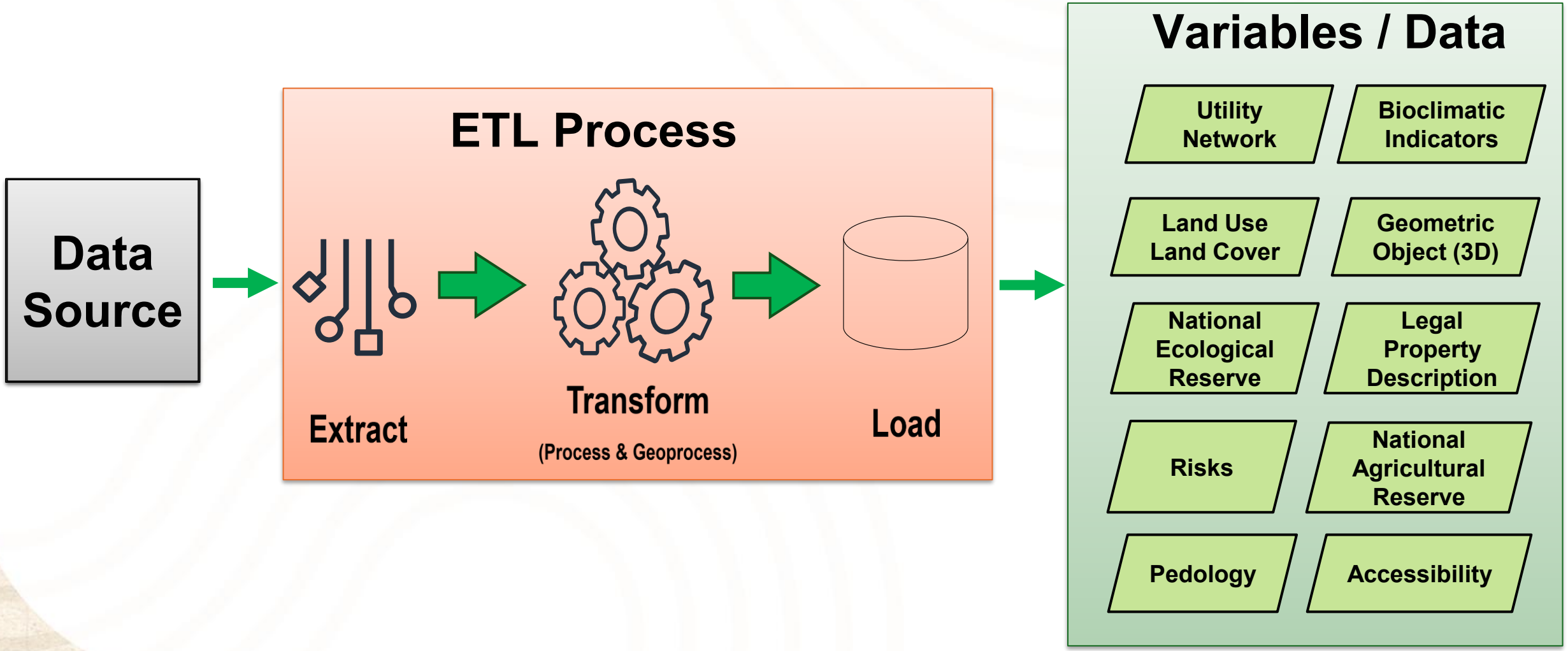
AND / OR

Agricultural profitability

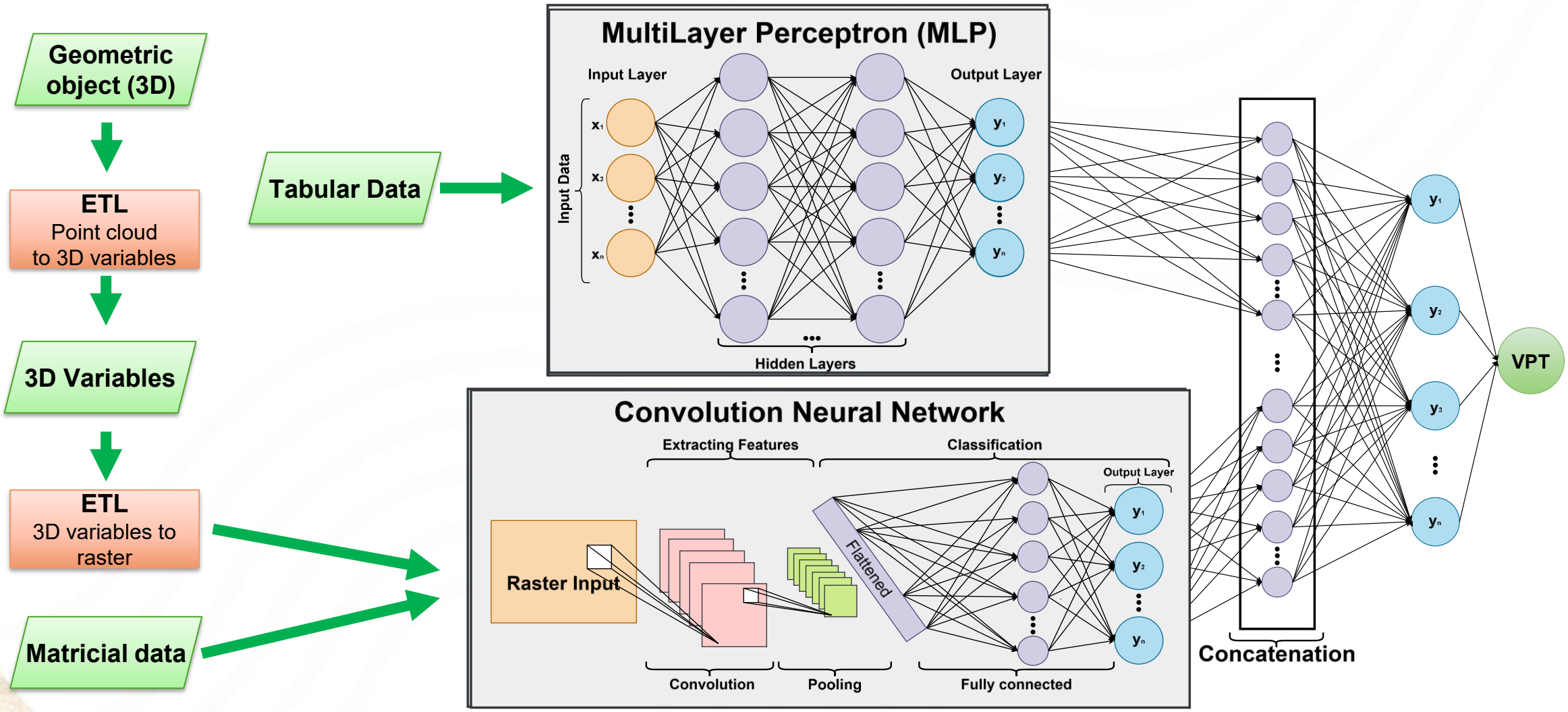
=

VPT

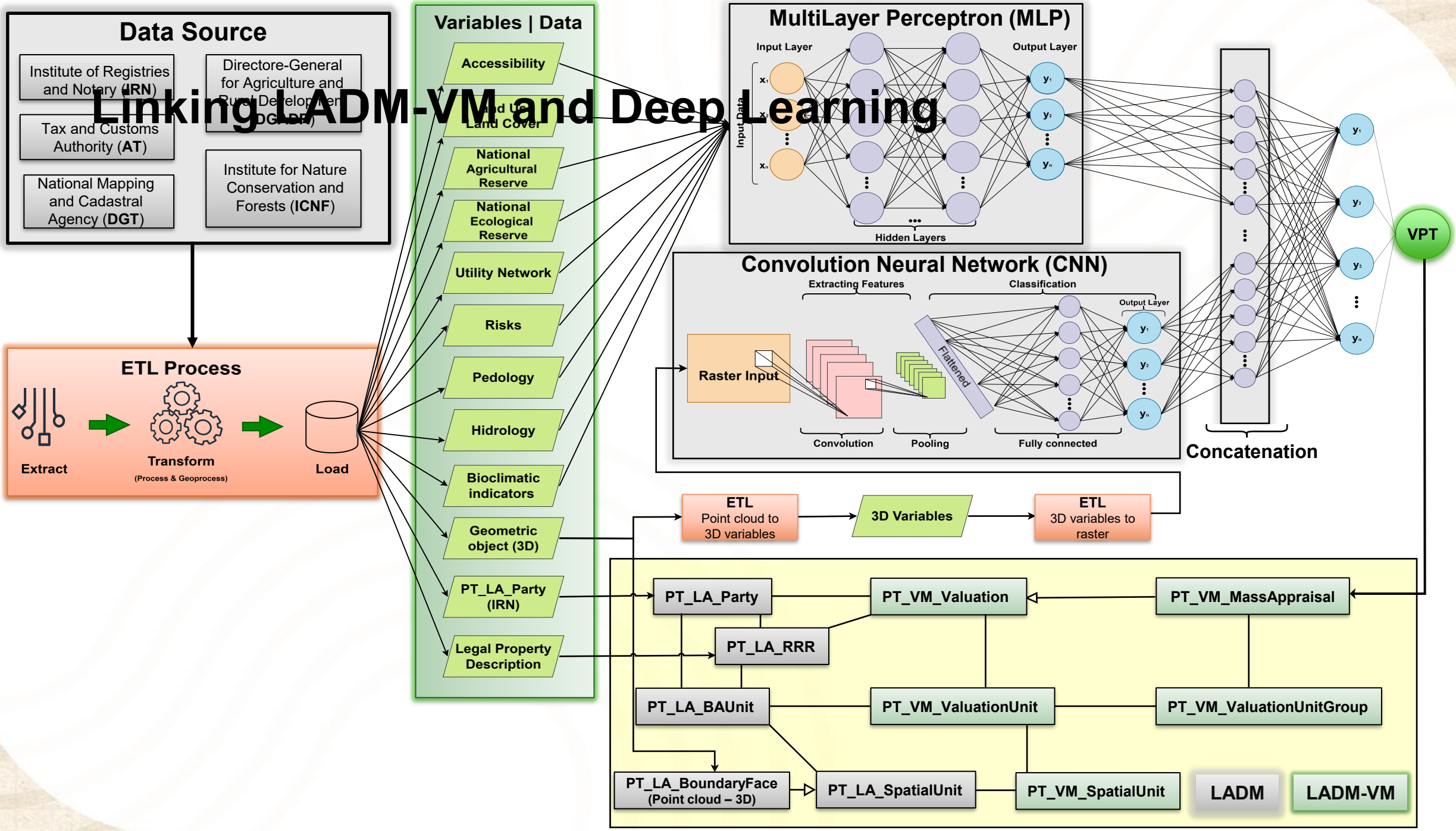
DL-BASED MODEL FOR TAX ASSET VALUE ESTIMATION



DL-BASED MODEL FOR TAX ASSET VALUE ESTIMATION



Linking LADM-VM and Deep Learning



CONCLUSION & FUTURE WORK

Conclusion

BUPi has advanced in rural property registration by integrating only 2D geometry

Adopting an international standard–aligned cadastral system remains essential

Current rural property valuation contributes only 0.5% of total property tax revenue

Thus

Conceptual model integrating 3D cadastral and property valuation based on LADM-VM and land profitability, estimated with Deep Learning

Future work

Design the UML diagram using standard LADM classes alongside newly recommended ones

Extract and transform geospatial and alphanumeric data to train and test the model

Use Python with key geoprocessing and DL libraries

Align LAS with LADM, complete code lists, and validate per ISO 19152:2012 Annex A

Test PointNet/PointNet++ for 3D point cloud processing

Develop the database structure and a Web3DGIS visualisation prototype

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Thank you!

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