INTRODUCTION TO WOOD IDENTIFICATION TECHNOLOGIES FOR STRENGTHENING CAPACITIES IN MEXICO

Machine Vision Wood Species Identification: Xyl⊚Tron

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UNEP & INTERPOL

"Environmental crime and the illegal grabbing of natural resources is becoming an ever more sophisticated activity requiring national authorities and law enforcement agencies to *develop responses commensurate with the scale and the complexity of the challenge* to keep one step ahead"

Develop responses commensurate with the scale and the complexity of the challenge

Develop technologies to combat illegal trade of wood and wood products

School of Environmental and Forest Sciences

- Center for International Trade in Forest Products
- Data collection
- Data validation
- Data analytics
- Machine vision
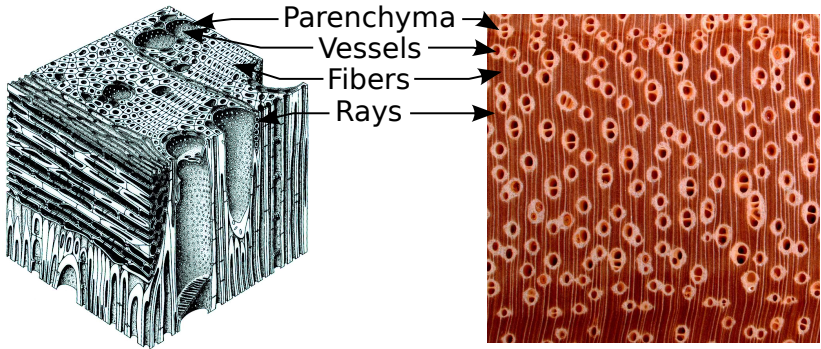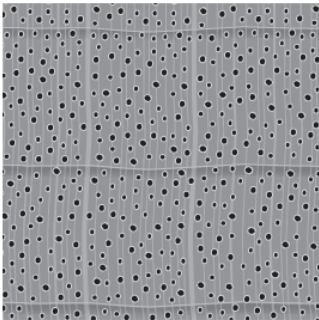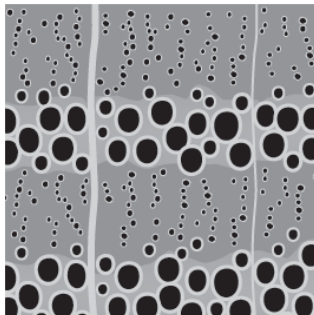- Artificial intelligence

Arbor Harbor

XyloTron

3D structure and 2D image of hardwood

Parenchyma
Vessels
Fibers
Rays

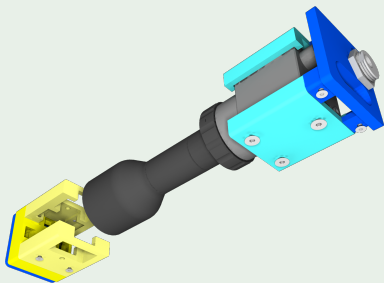## Wood identication overview

Diffuse

Ring

Machine vision based wood species identification

- Designed to be field portable
    - Ports of loading & entry
    - Logging sites
    - Lumber yards
    - Checkpoints
    - Sawmills
    - High–throughput
    - Easy–to–use
    - Economical
    - Repeatable
- Law enforcement
- Private sector supply chains

Pros and cons of a machine vision system for wood ID
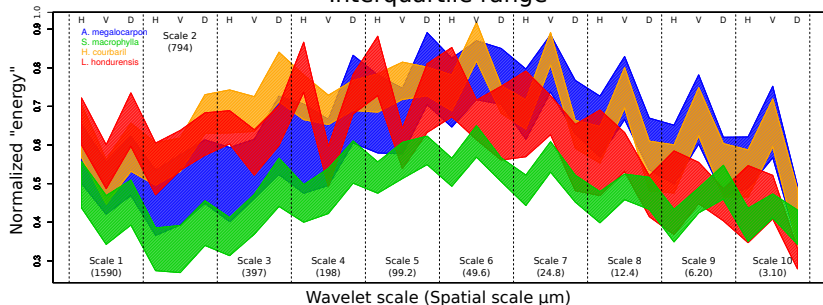
Pros

- Digital imaging can be more sensitive than the human eye
- Machine vision systems collect copious amounts of data
- Machines do not forget, get bored, promoted, fired, etcetera

Cons

- Requires investment to develop
- Machines are dumb
    - Garbage in garbage out
    - Requires robust programming
    - Needs "Big Data"
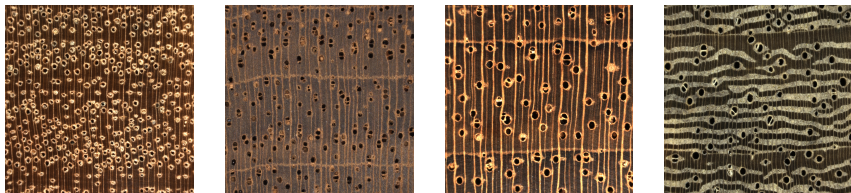
Interquartile range

Reference Image Collection

- 60000+ images
- 1000+ species
- Primarily from Central and South America
  - Belize
  - Brazil
  - Costa Rica
  - Guatemala
  - Honduras
  - Mexico
  - Nicaragua
  - Peru
- Expanding rapidly to Africa and Southeast Asia

Species

Genus

Family

Order

Class

Phylum

Kingdom

Confusion Matrix

- Comparing Dalgergias
    - *Dalbergia nigra*
    - *Dalbergia spruceana*
    - all other *Dalbergias* spp.

	Dalbergia nigra	*Dalbergia spruceana*	*Dalbergia* spp.
Dalbergia nigra	84	0	0
Dalbergia spruceana	2	44	0
Dalbergia spp.	0	1	91

98.7% overall accuracy

Current work in progress

- Expand the number of species
- Differentiate native vs plantation/managed
  Preliminary data suggests:
  - *Swietenia macrophylla* from Indonesia and Honduras
  - *Cedrela odorata* from Africa
- Self contained system (no laptop)
- Include species metadata (vernacular name, native distribution, etc.)

Tela, Honduras

Cost of ownership

Operating costs are minimal

- Re-charge the laptop
- Occasional software updates
- Cost for operator training is low
- Time per sample is low
- Specimen preparation supplies (blades, sandpaper, etc)

Maynor Lopez

Open system for cooperation

- Belgium
- Belize
- Brazil
- Canada
- Costa Rica
- France
- Ghana
- Guatemala
- Honduras
- Indonesia

- Japan
- Madagascar
- Mexico
- Netherlands
- Nicaragua
- Peru
- Russia
- Thailand
- United Kingdom
- Vietnam

Acknowledgements

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Maynor Lopez and all our international colleagues

Questions?

Nothing in Nature is random. ... A thing appears random only through the incompleteness of our knowledge.

Thank you!

Baruch Spinoza