The Accuracy of Photo-Based Plant Identification Apps on Northeastern Trees

Ryan J. Schmidt, Brianna Casario, Pam Zipse, Jason C. Grabosky

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New Jersey Agricultural Experiment Station

Introduction

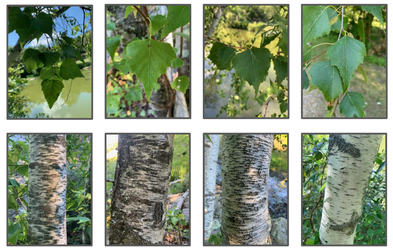
With the rise in the use of citizen scientists in urban forestry inventories, it is important to understand the strengths and limitations of photo-based plant identification apps as a tool for data collection in order to better understand the accuracy of the data being collected.

Methods

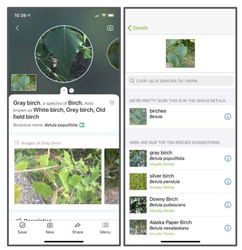
To test this, we collected 4 bark and 4 leaf photos from 55 common urban and forest tree species in New Jersey which were then uploaded to 6 of the most popular plant identification applications: *PictureThis*, *iNaturalist*, *Plant Identify*, *PlantNet*, *LeafSnap*, & *PlantSnap*.

The applications were then judged on their ability to correctly identify these trees to genus as well as to species.

We also set out to determine what, if any, trends exist in the application's ability to correctly identify different leaf morphologies and taxa and data was collected to determine which groupings showed either a high level of accuracy or an exceptionally low accuracy.



Sample: *Betula populifolia* (Photos by Ryan J. Schmidt CC-BY-NC-SA)



PictureThis ***iNaturalist***

Results

Overall, *PictureThis* showed the highest percent accuracy to genus and species followed by *iNaturalist*. *PlantSnap* was found to have the lowest level of accuracy of all of the tested applications and therefore was left out from general observations across all applications, but retained when making comparisons between applications.

The percent of correct leaf identifications was significantly higher than the bark identifications to genus and species for all taxa except the birches (*Betula*).

Of all the leaf photos, unlobed, simple leaves were the least accurate with the highest percentages being in compound and palmately lobed leaves. There was almost no difference between the applications' abilities to identify cone-bearing vs. broadleaf species.

These apps had a high genus-level identification rate for:

- *Acer*
- *Carya*
- *Picea*
- *Platanus*
- *Quercus*
- *Tilia*

They even had a moderately high accuracy in identifying maples (*Acer*) and spruces *(Picea*) to the species level.

It is also important to note that while the applications had high accuracy for these genera, many photos were lumped into a common species-level identification in error: of these, Carya glabra (45 times), Fraxinus americana (39), Betula pendula (34), Liquidambar styraciflua (32), and Acer platanoides (29) were the most frequently misidentified. The applications were also very inaccurate in their genus-level identifications of magnolia (*Magnolia*) and birch *(Betula*) species.

Discussion

Ultimately, in terms of the identification of Northeastern trees, the use of either the *PictureThis* or *iNaturalist* app would most likely offer the most accurate leaf identifications to genus in the field. As these identifications are only marginally successful in identifying trees to the species level, these applications should only be used to either:

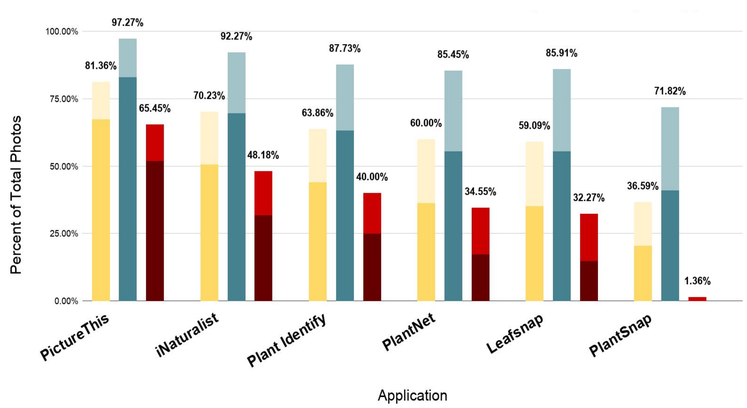
- inform surveyors when only a genus level identification is desired,
- distinguish between similar-looking genera with high accuracy levels (i.e. *Platanus* & *Acer* or *Picea* & *Pinus*),
- offer a second opinion to a trained surveyor on a difficult identification, or
- refine the species that a surveyor needs to identify between in a traditional identification resource.

It is clear that although these apps offer valuable information to less confident botanists, in order to obtain accurate data, surveyors must be able to verify these identifications on their own.

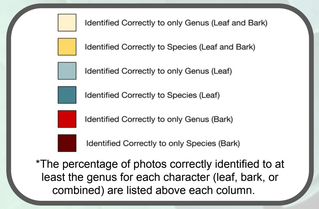
Conclusion

These identification apps should be used as one of many tools to aid in tree identification and not a replacement for traditional field identifications.

Percent Identification per Application



Key



*The percentage of photos correctly identified to at least the genus for each character (leaf, bark, or combined) are listed above each column.

Citations

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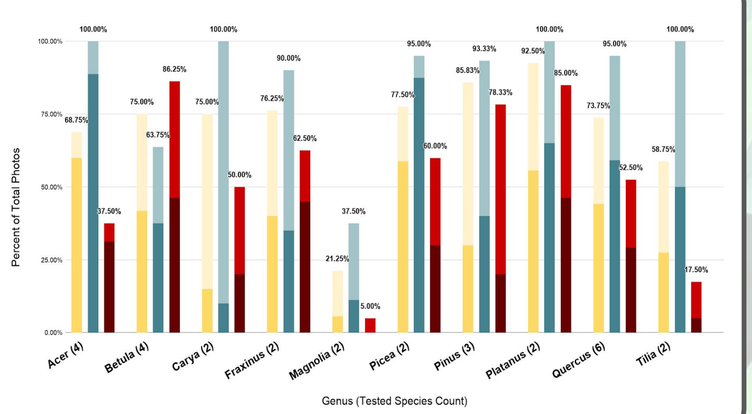
Percent Identification per Genus



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