

# Reconciling Taxonomies of Electoral Constituencies and Recognized Tribes of Indigenous Taiwan

Yi-Yun Cheng, Bertram Ludäscher

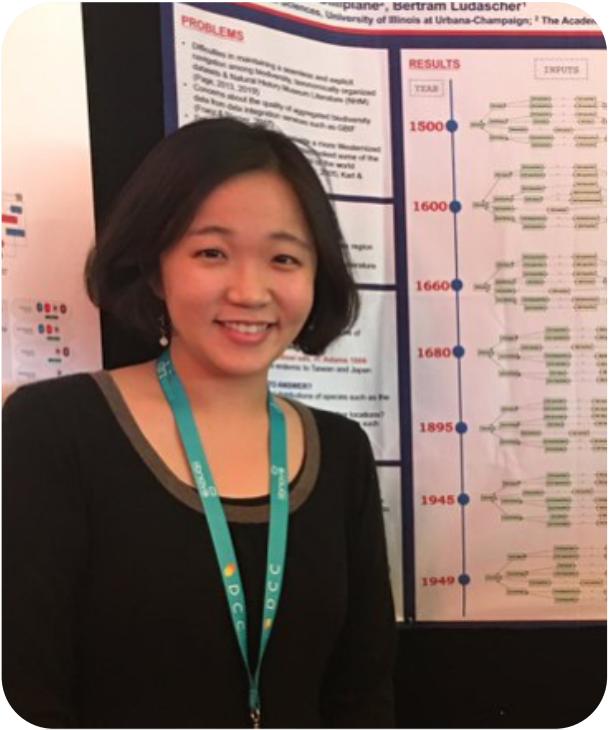
School of Information Sciences, University of Illinois at Urbana-Champaign

{yiyunyc2, ludaesch} @ illinois.edu

<https://github.com/EulerProject/ASIST20>



# The authors



Jessica Yi-Yun Cheng  
@yiyunjessica



Bertram Ludäscher  
@ludaesch

# Introduction

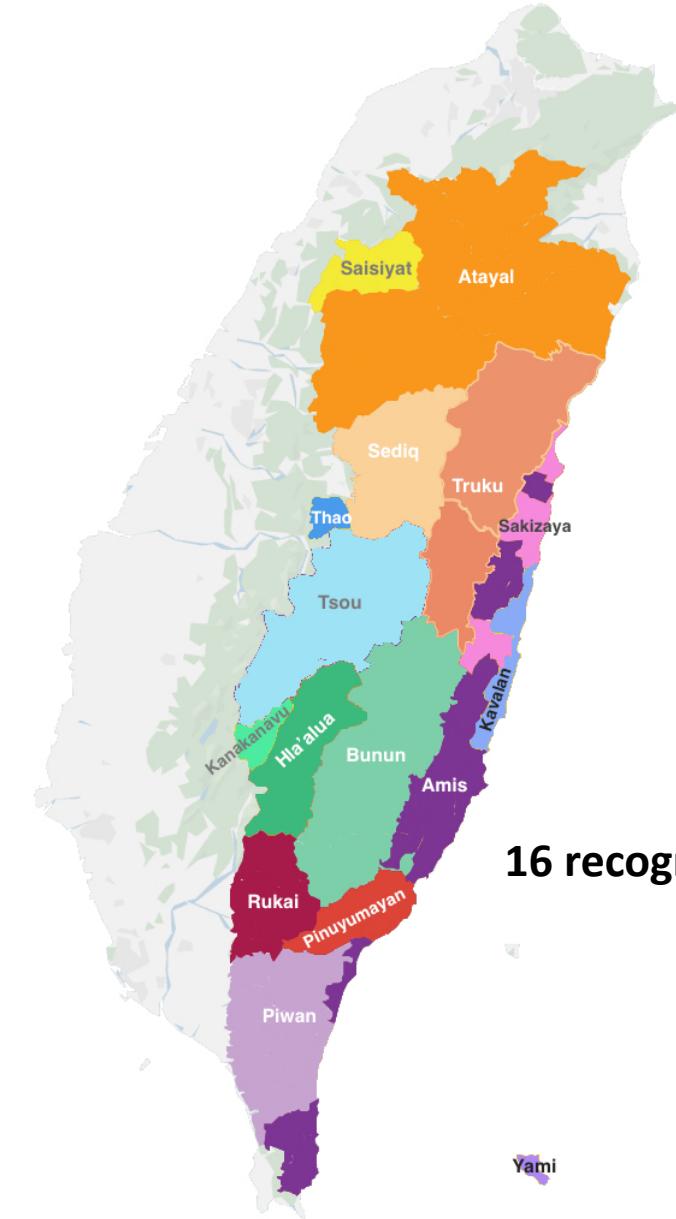
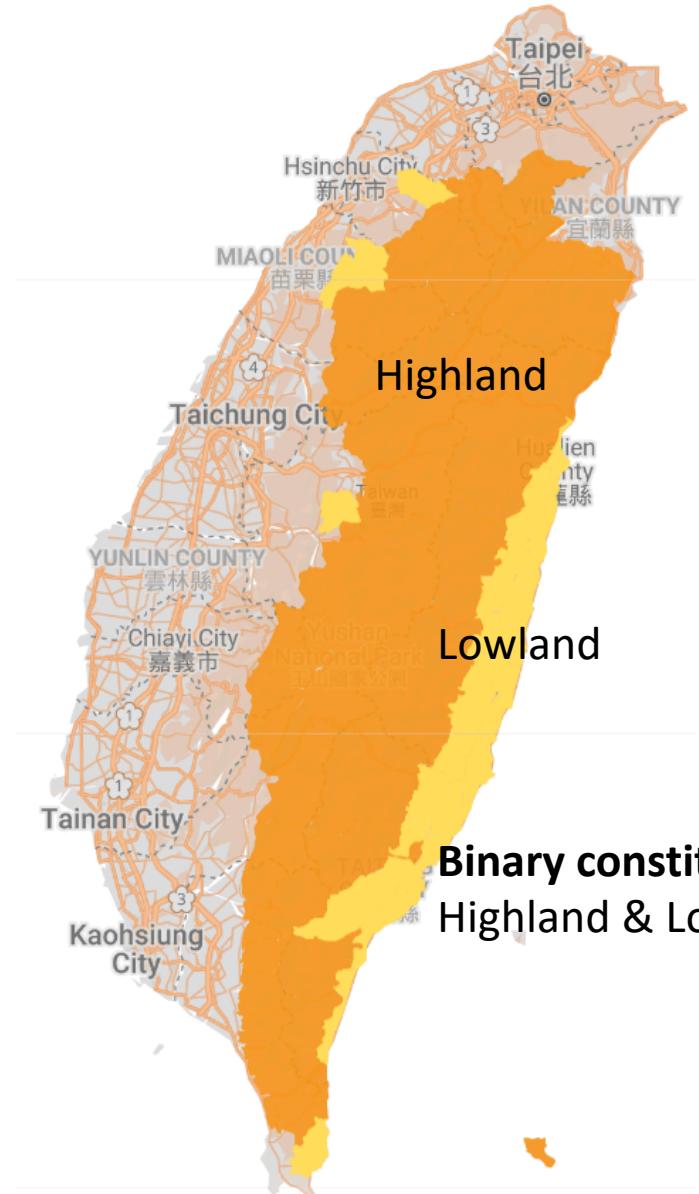


- Biases in bibliographic classifications has been studied thoroughly in the field of Knowledge Organization:
  - race (Higgins, 2016), gender (Olson, 2003), ethnic minorities (Hajibayova et al, 2017), indigenous peoples (Littletree & Metoyer, 2015)
- Latent assumptions in everyday geopolitical taxonomies are sometimes difficult to unwind
  - people's belief on the categorization of indigenous people's tribes is highly informed by the authorities (Jarvis, 2017; McLaughlin, 2019)

# Goals of this research



- Examining the taxonomies of the Taiwanese Indigenous Peoples' tribes and the indigenous constituencies (voting groups) of the legislature representatives from 2000-2020
- Taiwan's legislator Reserved seat system:
  - 113 legislators, 6 are reserved for indigenous candidates
  - 6 indigenous legislators: 3 are 'Highland' candidates, 3 are 'Lowland' candidates
- What we're comparing
  - the division of multiple tribes into dichotomous voting groups, historically created during the Japanese colonization period;
  - the evolving classification of the federally recognized indigenous tribes



# Related Work & Background



- Bias in Knowledge Organization Systems
- Indigenous Knowledge Organization
- Taiwan Indigenous Classification and Electoral Constituencies
  - tribes have been federally recognized and added since the year 2000, evolving from only 9 groups to the now 16 tribes
  - the “reserved seats” system is often questionable given that the constituencies (voting groups) are divided in a dichotomy that was developed during the 1940s Japanese colonization period and still used in present day

# Recognized Tribes over time



Year	Number	Tribes
1948-2000	9	Amis, Atayal, Paiwan Bunun, Rukai, Pinuyumayn Tsou, Saisyat, Yami
2001	10	+Thao (org. Tsou)
2002	11	+Kavalan (org. Amis)
2004	12	+Truku (org. Atayal)
2007	13	+Sakizaya (org. Amis)
2008	14	+Seediq (org. Atayal)
2014-	16	+Hla'alua, Kanakanavu (both org. Tsou)

Soruce: Templeman (2018) and Tsai (2017)

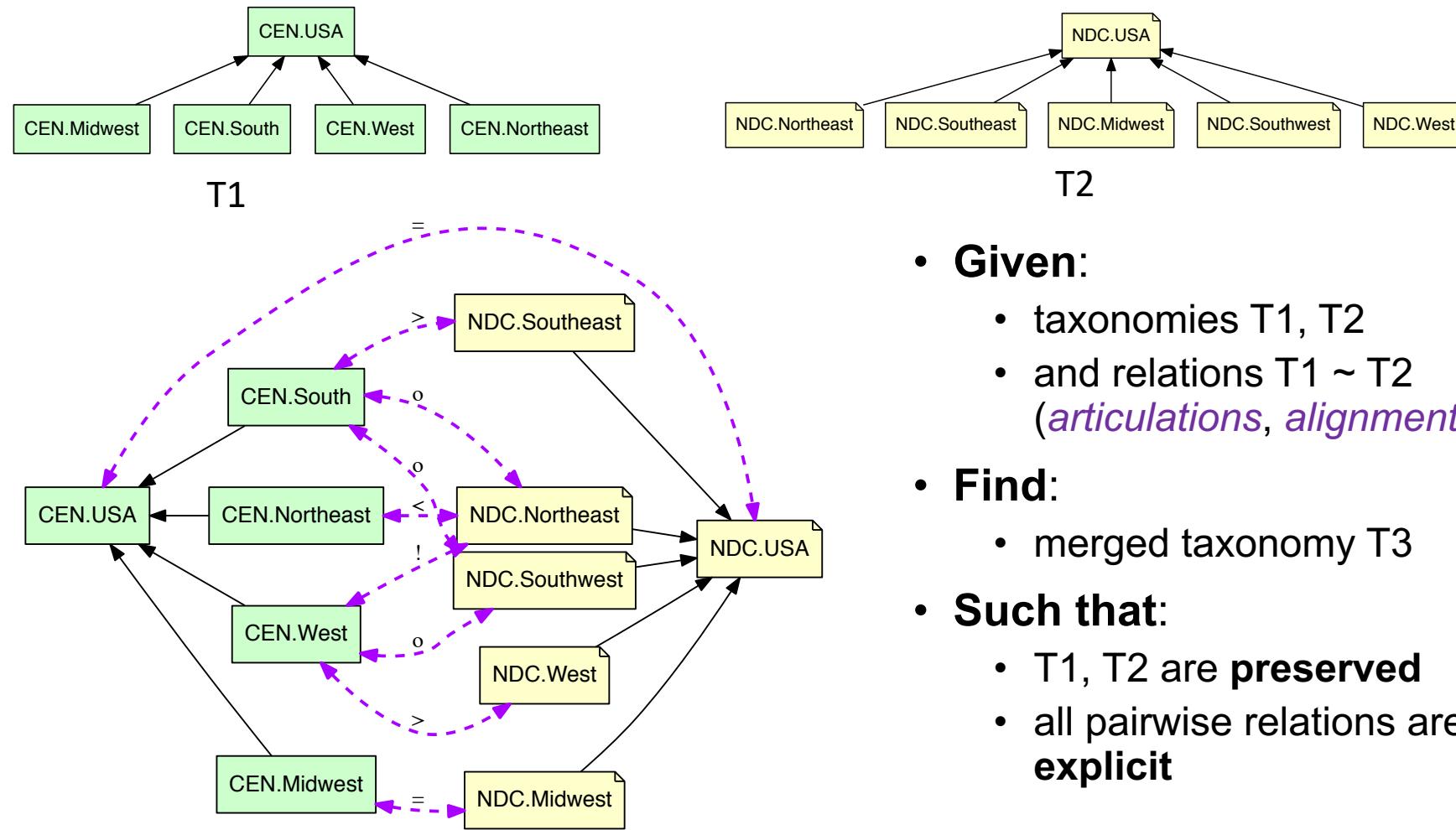
# Data Collection



- Tribal background information
  - Data about the now 16 recognized tribes (from Council of Indigenous Peoples in Taiwan, CIP)
  - Evolving number of recognized tribes from 9 to 16
- Indigenous electoral constituencies information
  - from Taiwan's Central Election Commission Database and CIP
- Indigenous population dataset
  - from CIP, as of April 11<sup>th</sup>, 2020

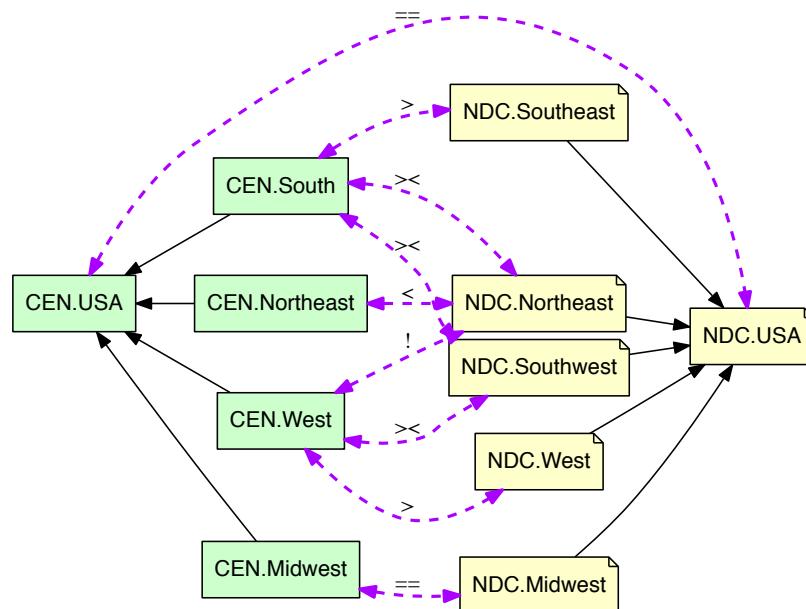
Tribes	Lowland	Highland	Population	Percentage				
Amis	212611 (99.44%)	1199 (0.56%)	213810	38.06				
Paiwan	21419 (20.81%)	81512 (79.19%)	102931	18.32				
Atayal	1871 (2.03%)	90364 (97.97%)	92235	16.42				
Bunun	364 (0.61%)	59248 (99.39%)	59612	10.61				
Truku	147 (0.45%)	32263 (99.55%)	32410	5.77				
Pinyumayan	14446 (99.23%)	112 (0.77%)	14558	2.59				
Rukai	2644 (19.60%)	10847 (80.40%)	13491	2.40				
Sediq	15 (0.14%)	10455 (99.86%)	10470	1.86				
Saisyat	4506 (66.89%)	2230 (33.11%)	6736	1.20				
Tsou			15 (0.22%)	6686 (99.78%)	6701		1.19	
Yami			12 (0.26%)	4681 (99.74%)	4693		0.84	
Kavalan			1499 (99.87%)	2 (0.13%)	1501		0.27	
Sakizaya			986 (99.80%)	2 (0.20%)	988		0.18	
Thao			811 (99.14%)	7 (0.86%)	818		0.15	
Hlaalua				420				
Kanakanavu			0	(100%)	420		0.07	
Total			261346	300394	561740		100	

# Sorting things out ... (Cheng et al, 2017)

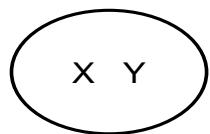


- **Given:**
  - taxonomies T1, T2
  - and relations T1 ~ T2 (*articulations, alignment*)
- **Find:**
  - merged taxonomy T3
- **Such that:**
  - T1, T2 are **preserved**
  - all pairwise relations are **explicit**

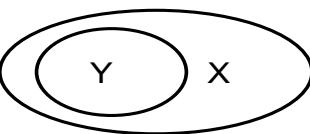
# 5 ways to relate concepts (regions)



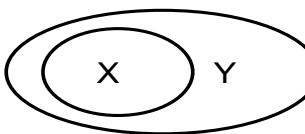
- Idea: relate concepts X and Y with *articulations*
- Articulation Language: **Region Connection Calculus (RCC5)**: congruence, inclusion, inverse inclusion, overlap, disjointness



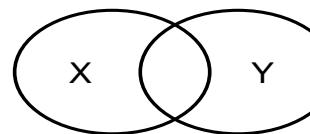
Congruence  
 $X == Y$



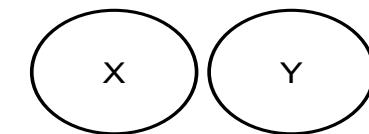
Inclusion  
 $X > Y$



Inverse Inclusion  
 $X < Y$

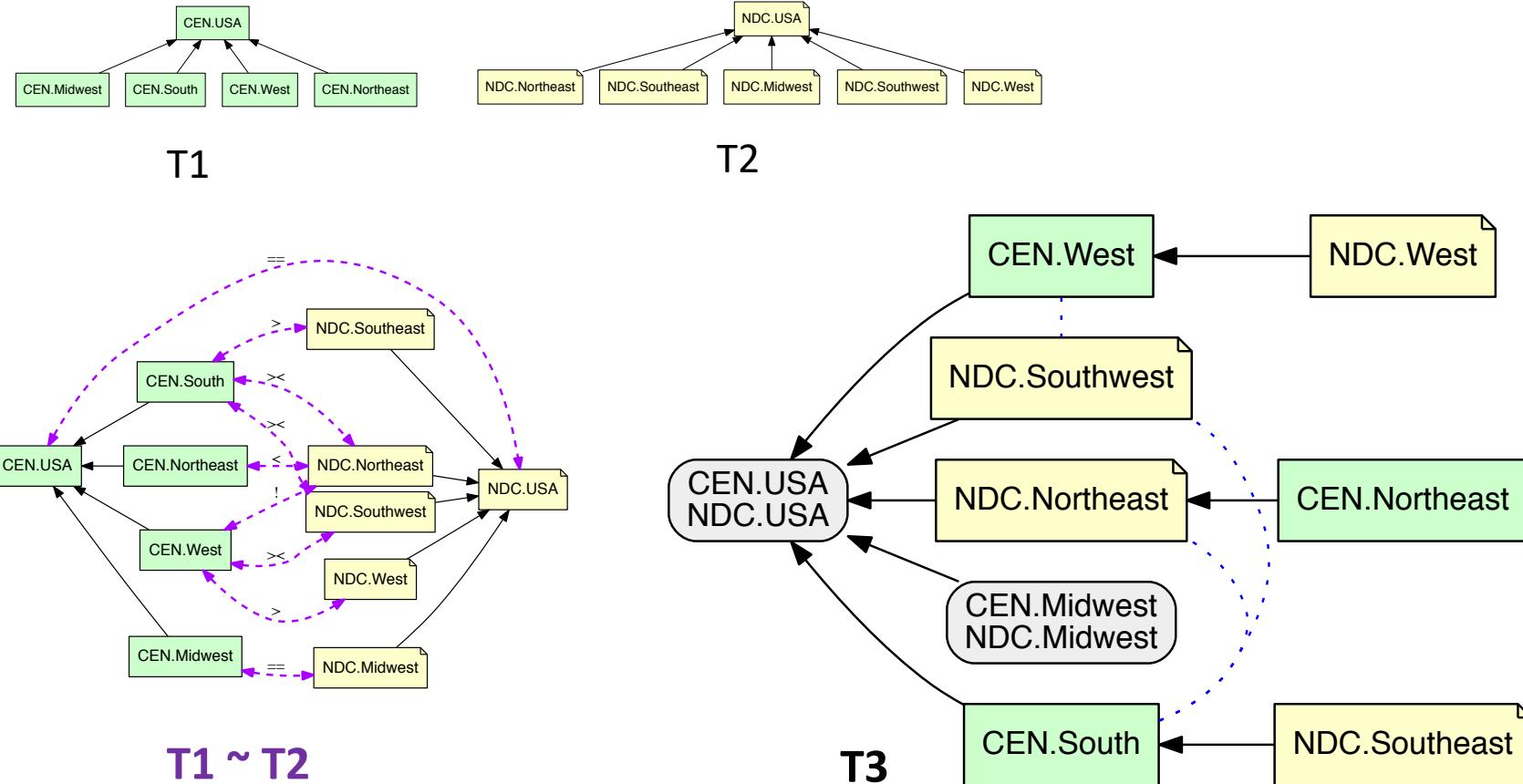


Overlap  
 $X >< Y$



Disjointness  
 $X ! Y$

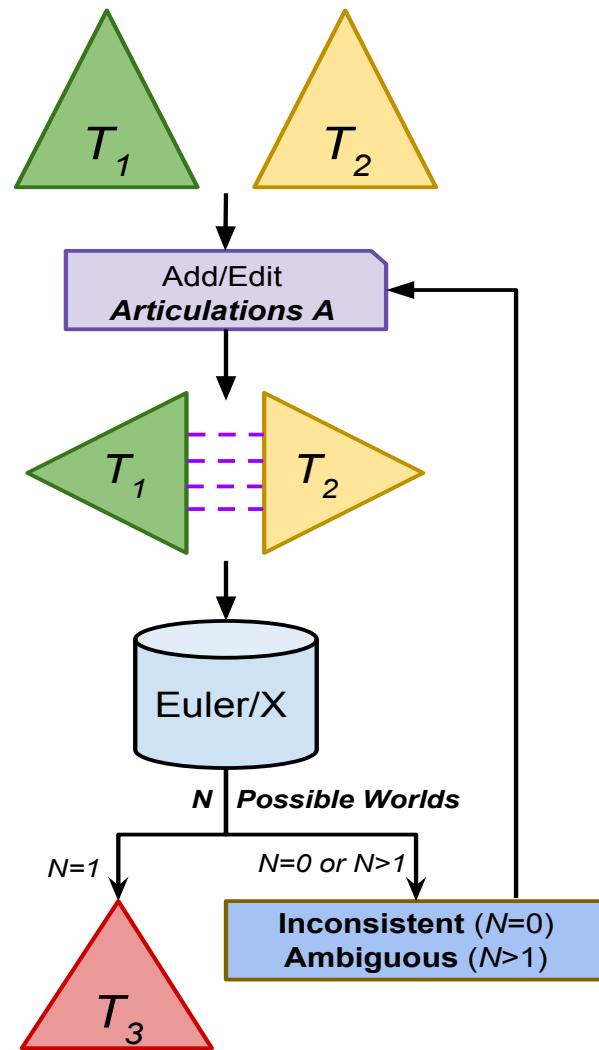
# Merged taxonomy T3



# How we align two taxonomies $T_1$ and $T_2$



- **Step 1.** Supply input taxonomies  $T_1$  and  $T_2$
- **Step 2.** Describe the relationships between  $T_1$  and  $T_2$
- **Step 3.** Iteratively edit articulations in Euler/X
- ... but where do the *articulations* come from??
  - expert opinion
  - automatically derived from data



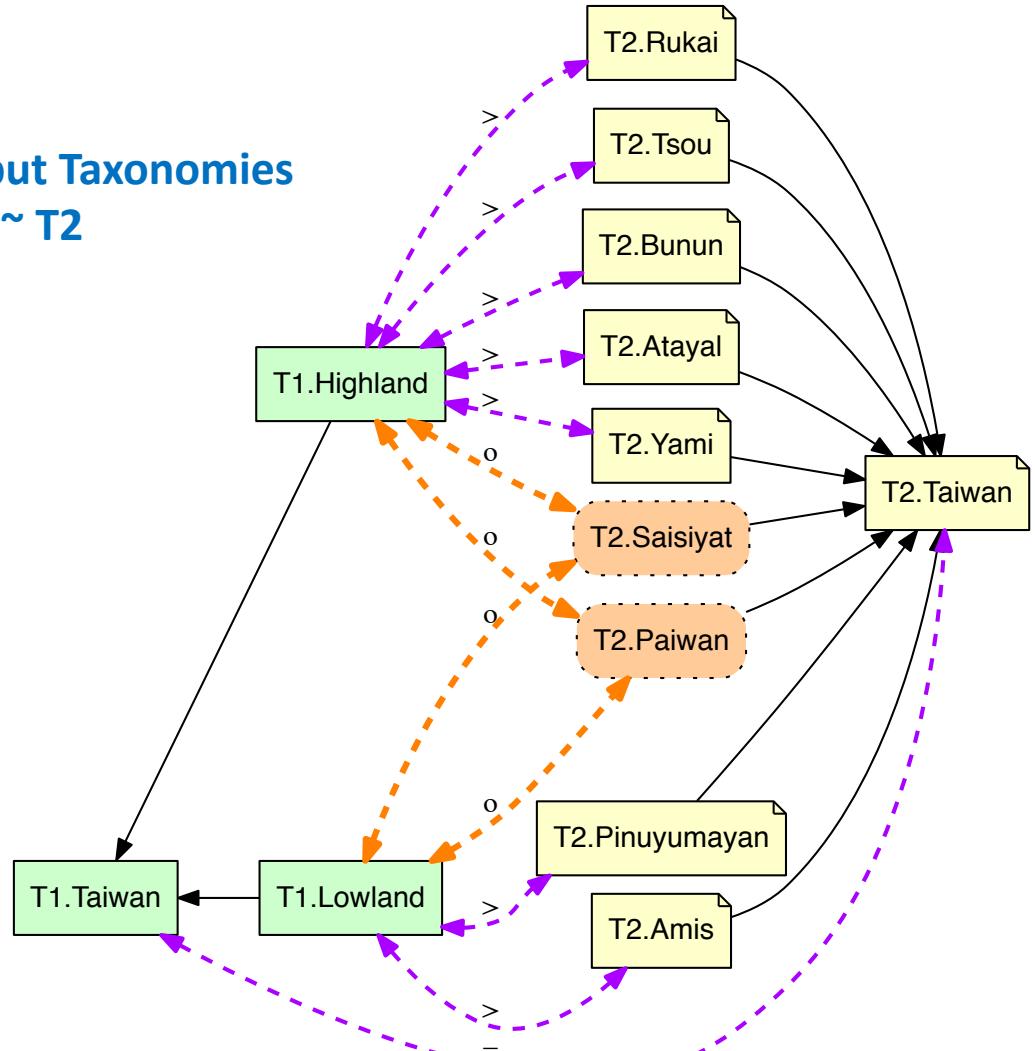
# Input Taxonomies for this research



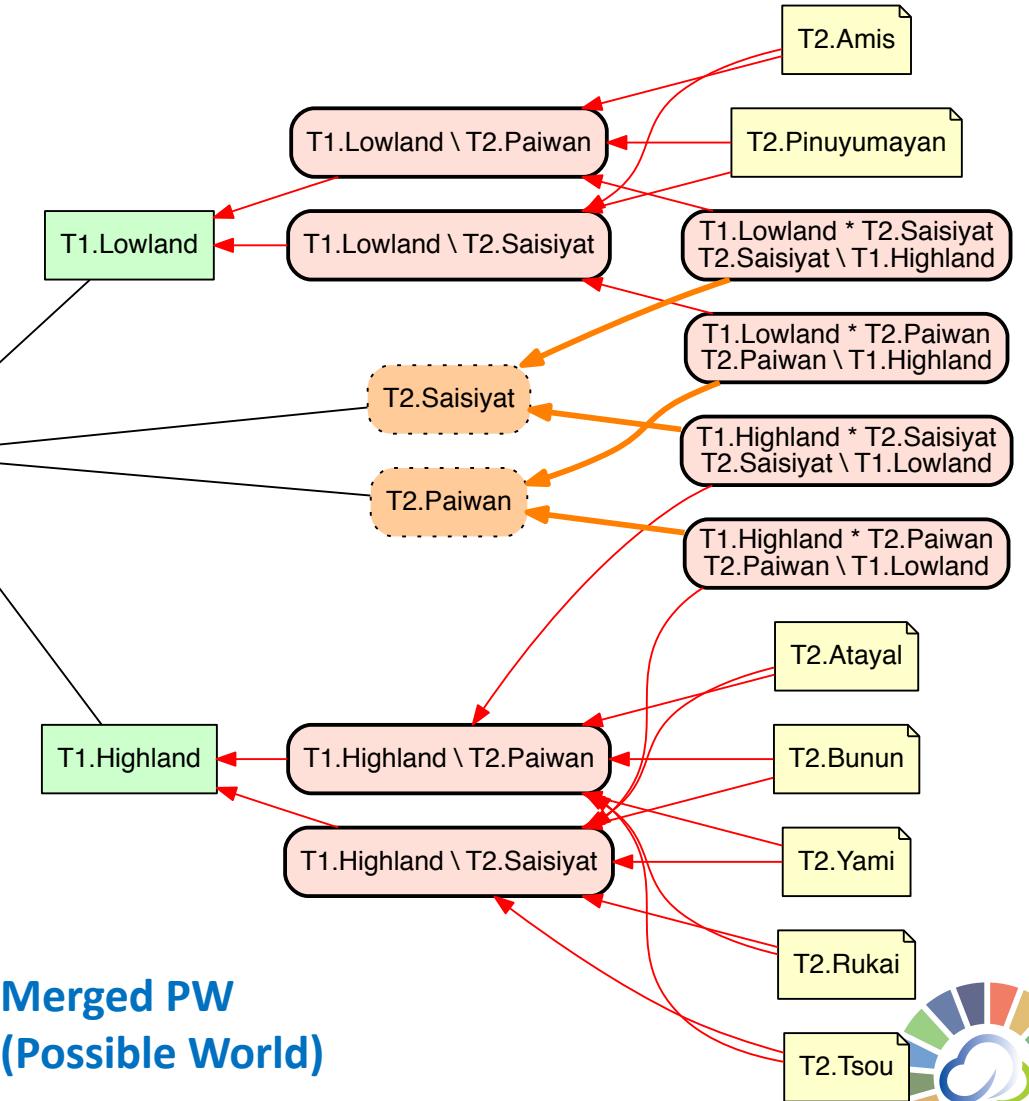
- $T_1$ : *The Bipartite Electoral Constituencies, Lowland and Highland (LH)*
- $T_2$ : *Recognized tribes in the past – 9 tribes*
- $T_3$ : *Recognized tribes in the present – 16 tribes*
- $T_4$ : *Other tribes – 26 tribes*
- $T_5$ : *Re-scaled groups based on population percentage – 5 groups*

# Taxonomy Alignment Problem 1: T1.LH versus T2.9 tribes

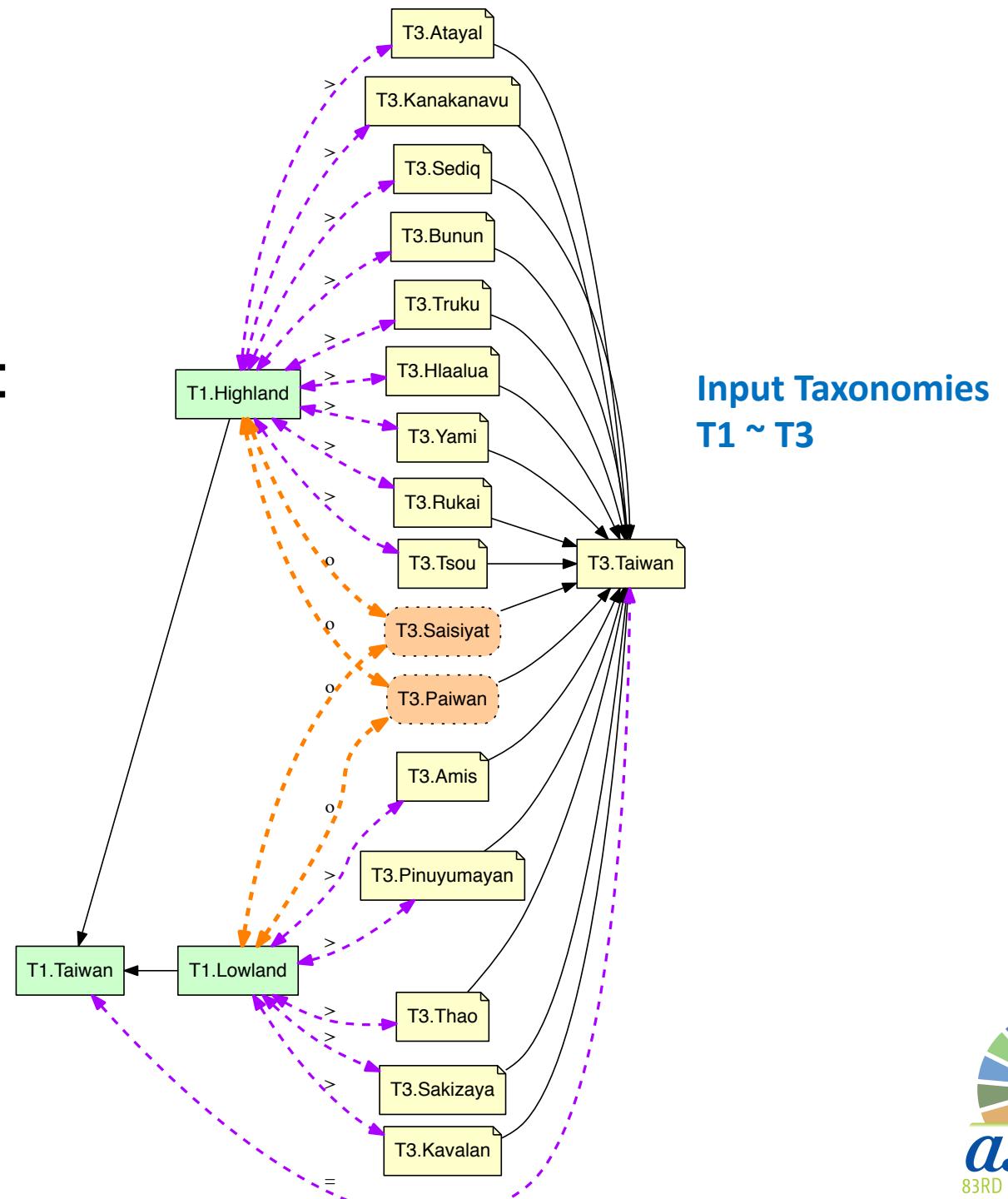
**Input Taxonomies**  
**T1 ~ T2**



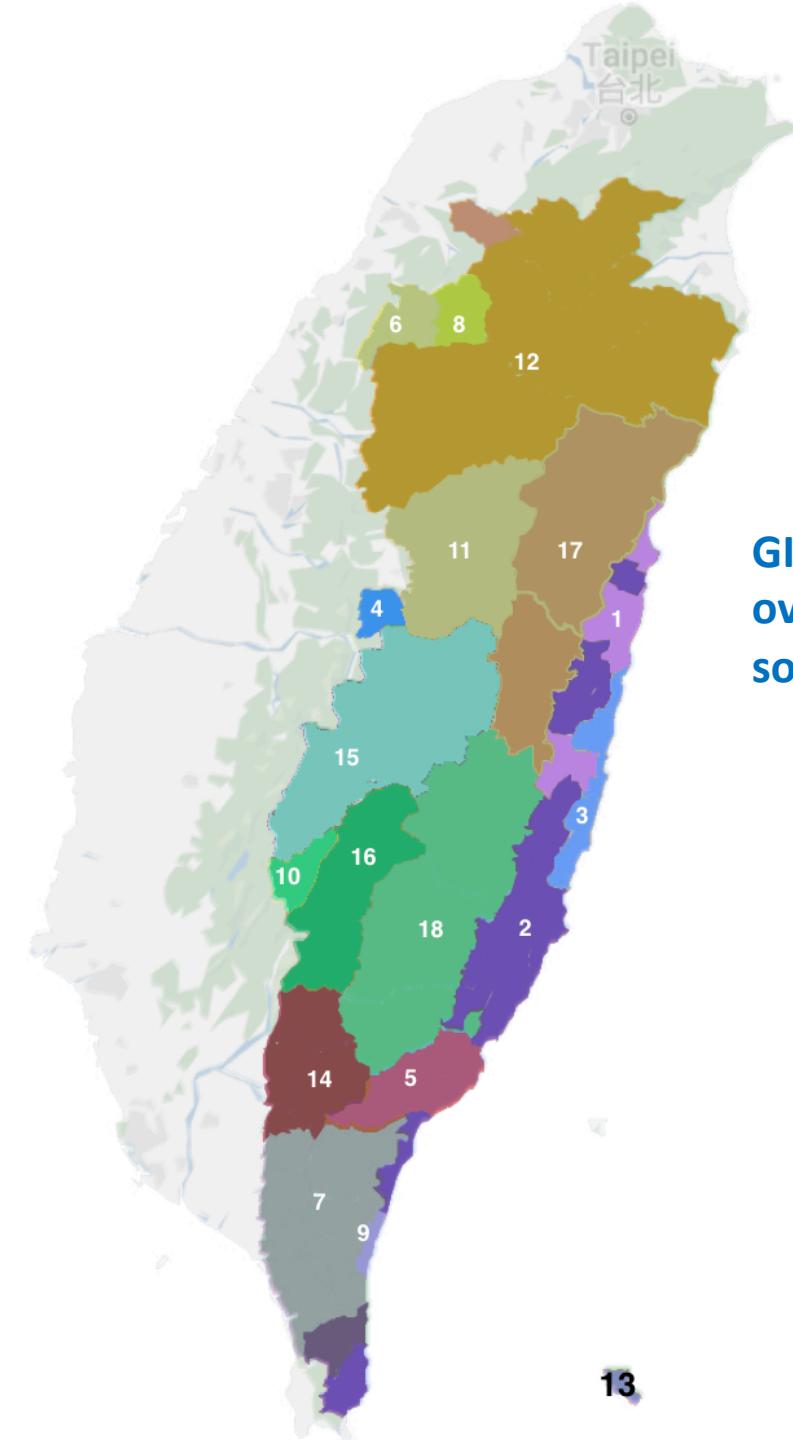
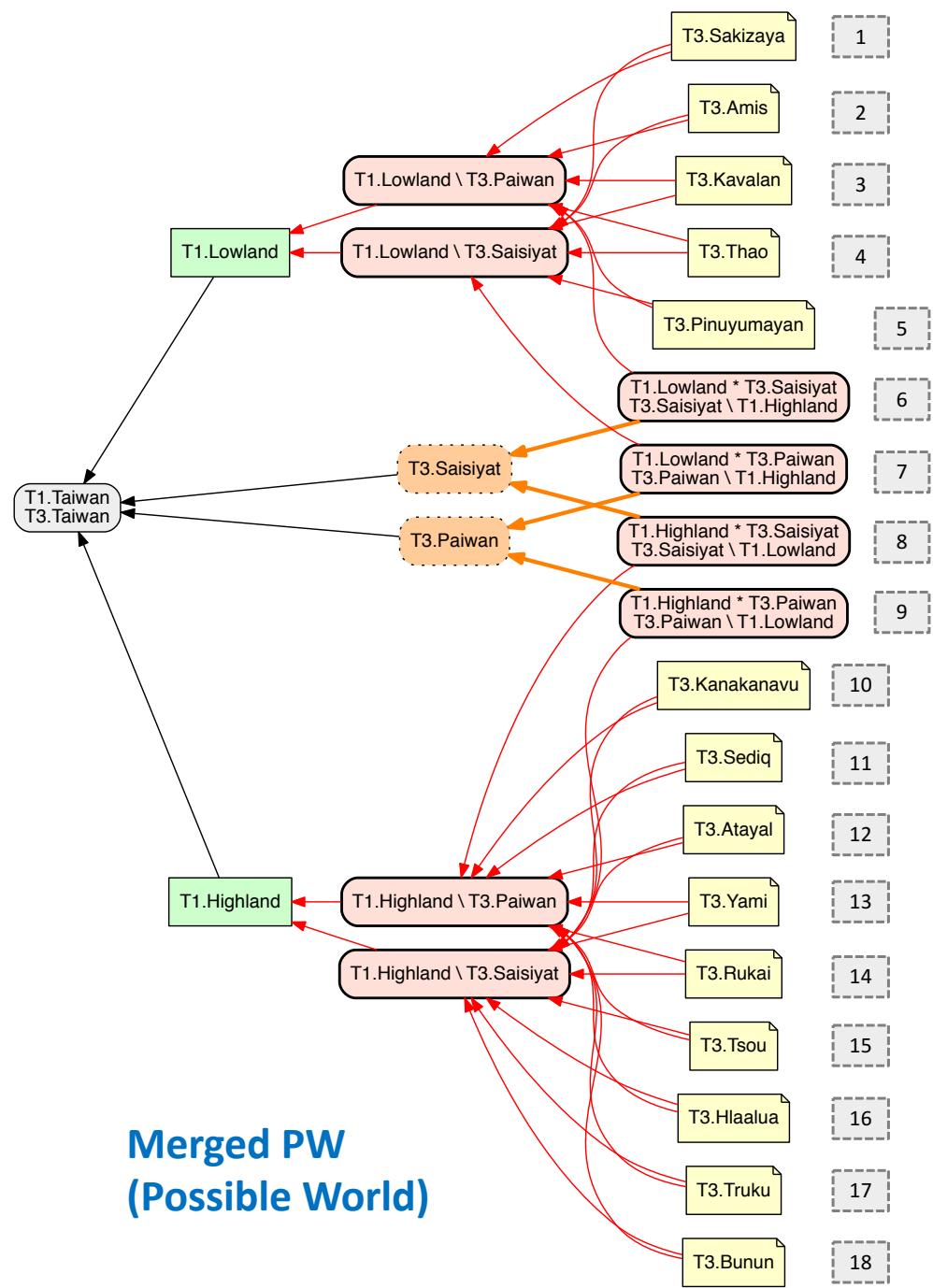
**Merged PW  
(Possible World)**



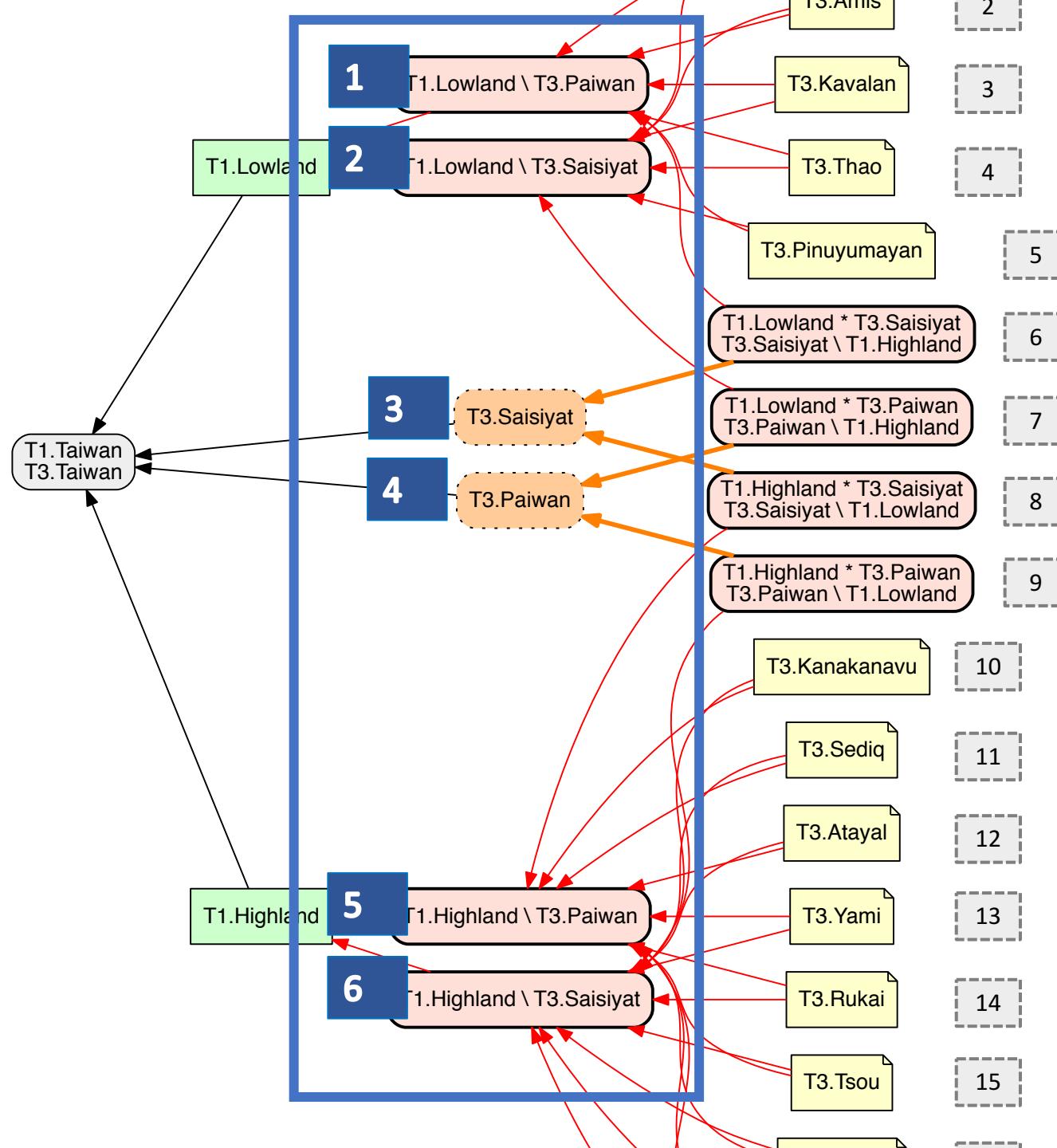
# Taxonomy Alignment Problem 2: **T1.LH versus T3. 16 tribes**



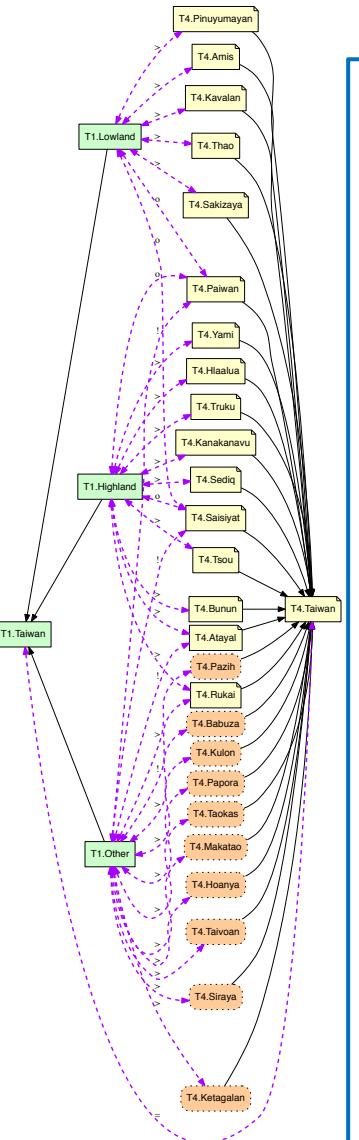
## Merged PW (Possible World)



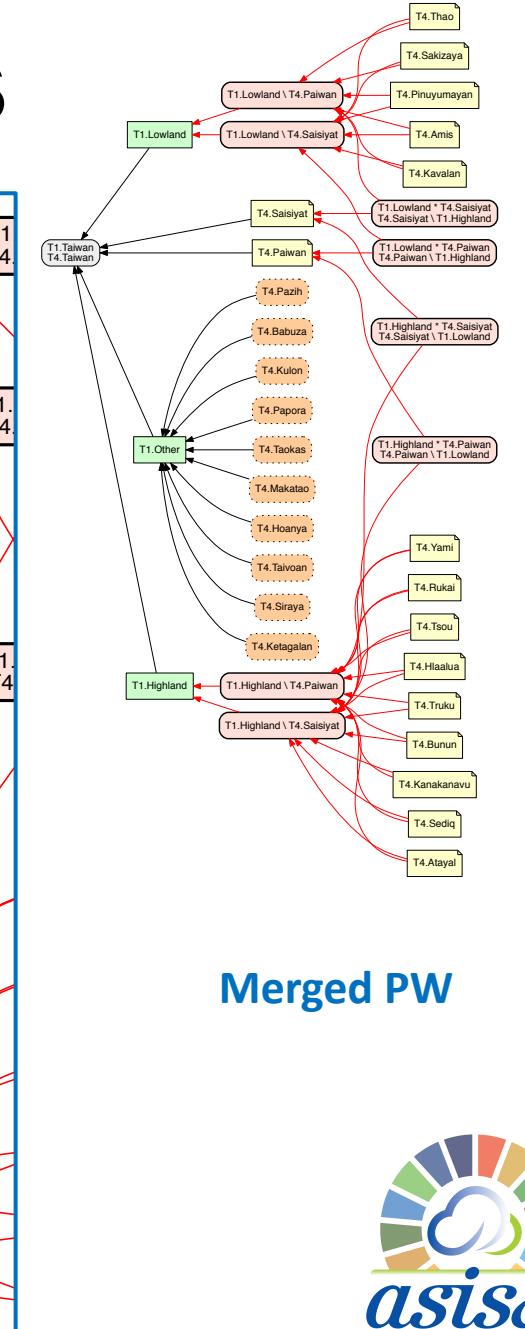
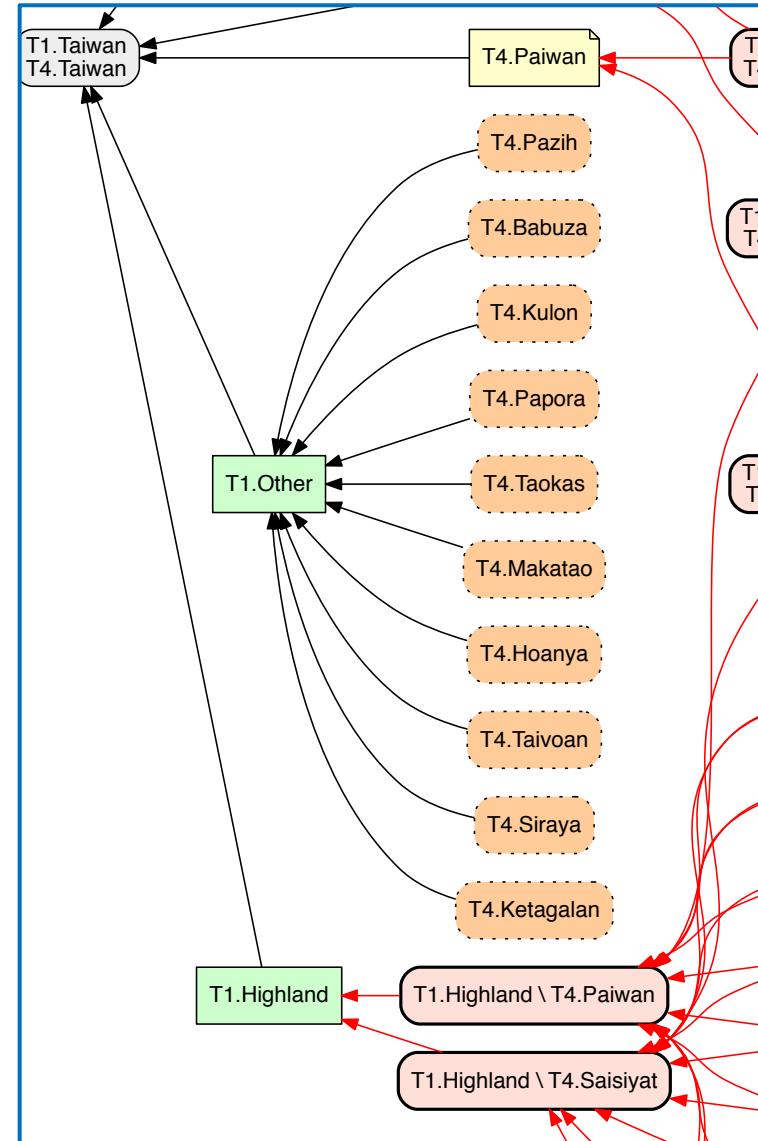
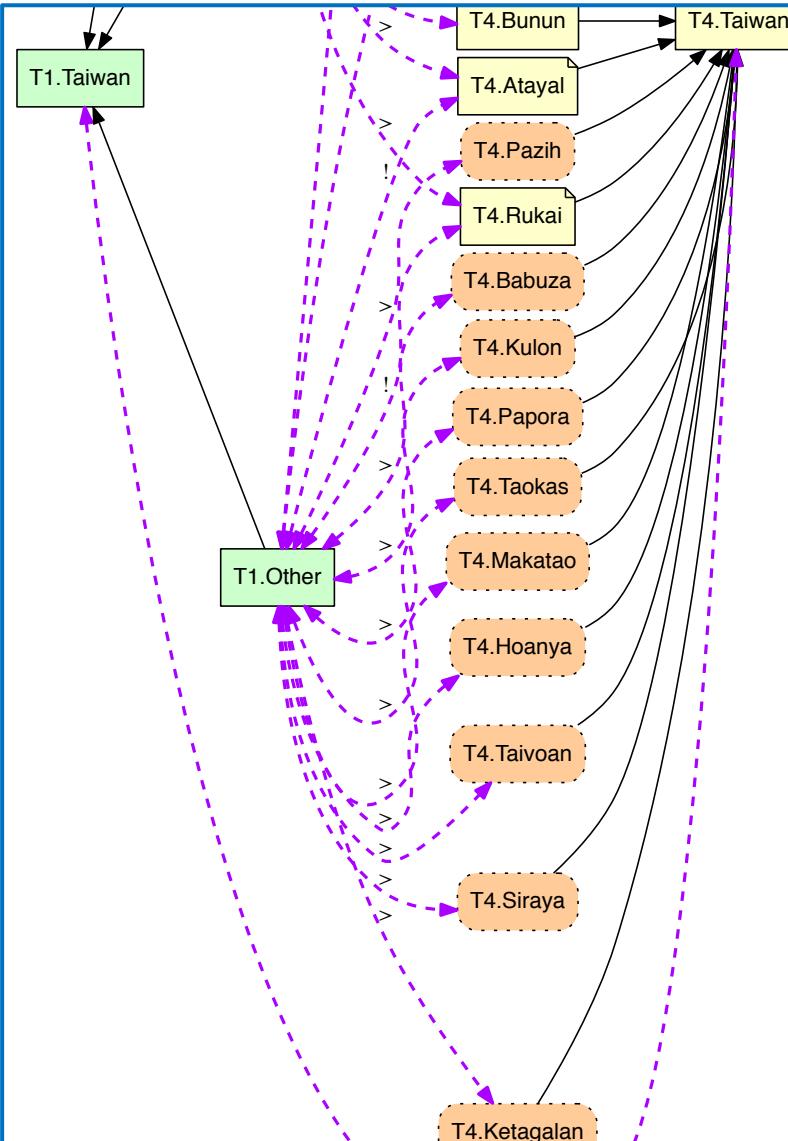
GIS map  
overlaid  
solution



**Input Taxonomies**  
**T1 ~ T4**

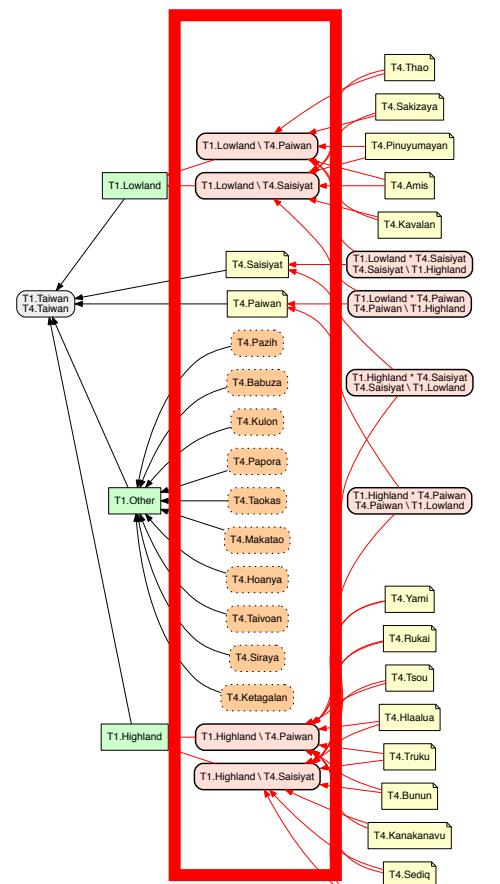
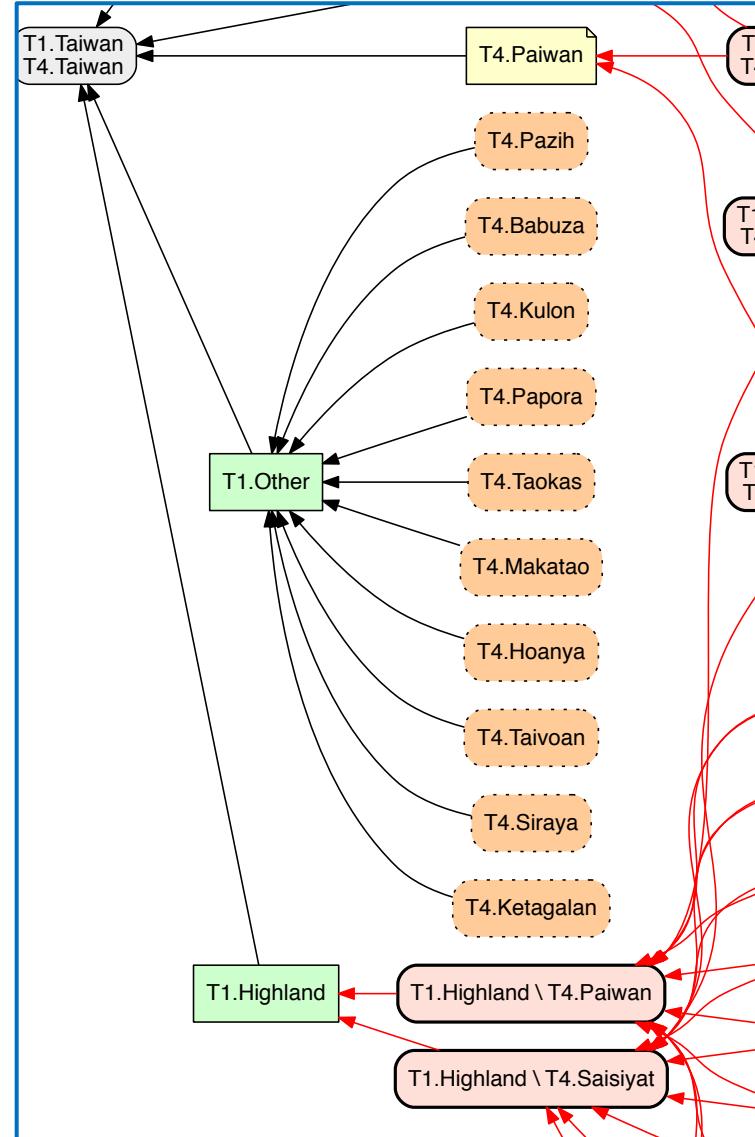
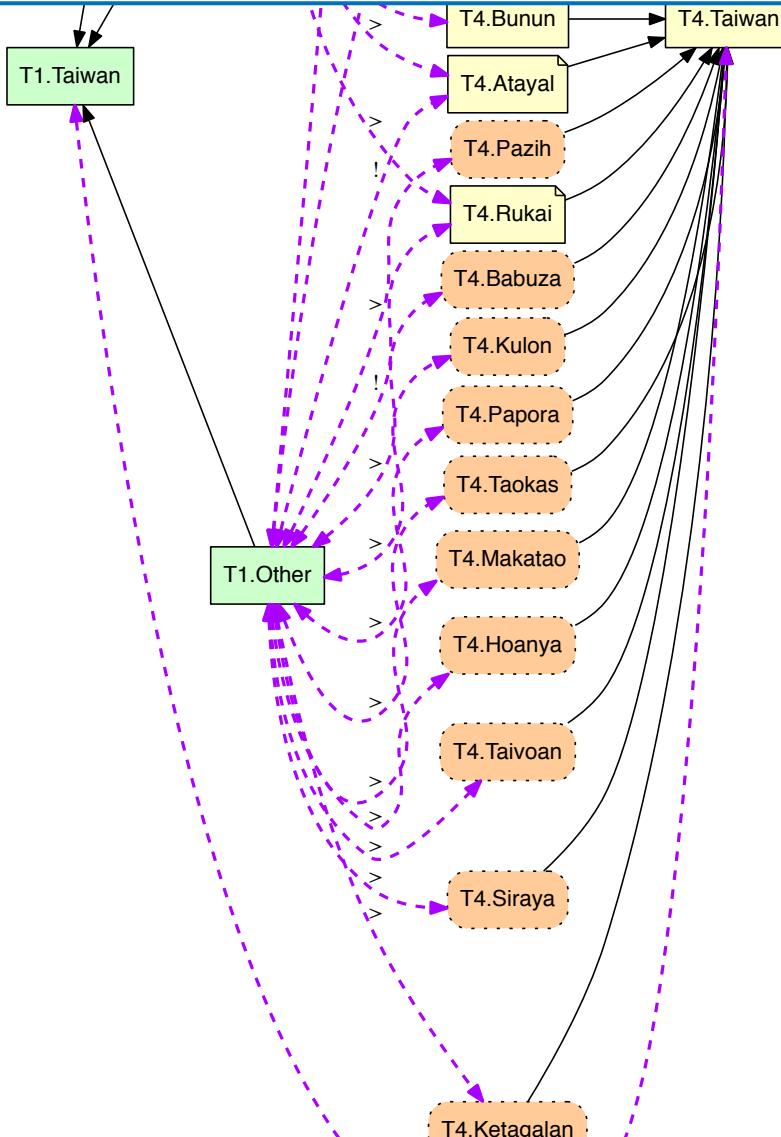
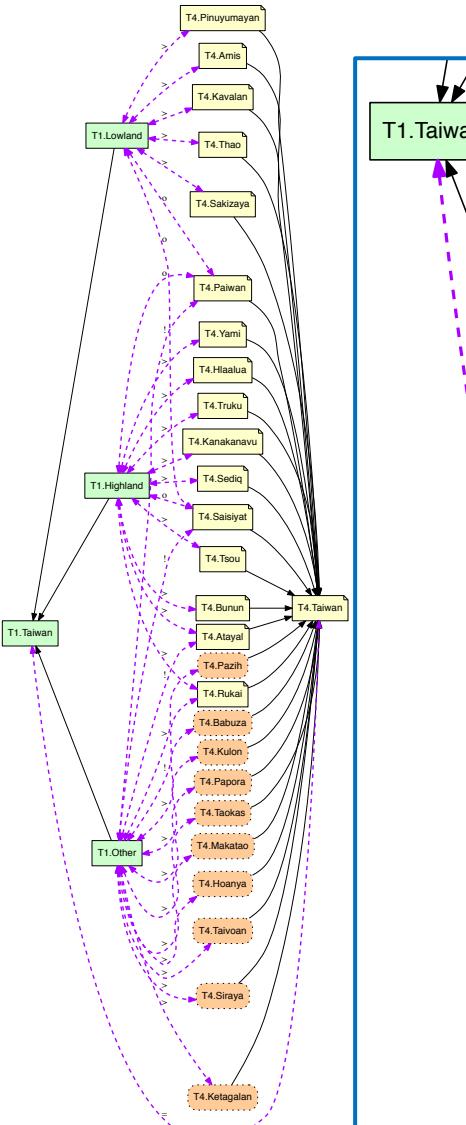


# Taxonomy Alignment Problem 3: **T1.LH versus T4.26 tribes**



**Merged PW**

**Input Taxonomies**  
**T1 ~ T4**



**Merged PW**

Tribes	Lowland	Highland	Population	Percentage				
Amis	212611 (99.44%)	1199 (0.56%)	213810	38.06				
Paiwan	21419 (20.81%)	81512 (79.19%)	102931	18.32				
Atayal	1871 (2.03%)	90364 (97.97%)	92235	16.42				
Bunun	364 (0.61%)	59248 (99.39%)	59612	10.61				
Truku	147 (0.45%)	32263 (99.55%)	32410	5.77				
Pinyumayan	14446 (99.23%)	112 (0.77%)	14558	2.59				
Rukai	2644 (19.60%)	10847 (80.40%)	13491	2.40				
Sediq	15 (0.14%)	10455 (99.86%)	10470	1.86				
Saisyat	4506 (66.89%)	2230 (33.11%)	6736	1.20				
Tsou			15 (0.22%)	6686 (99.78%)	6701	1.19		
Yami			12 (0.26%)	4681 (99.74%)	4693	0.84		
Kavalan			1499 (99.87%)	2 (0.13%)	1501	0.27		
Sakizaya			986 (99.80%)	2 (0.20%)	988	0.18		
Thao			811 (99.14%)	7 (0.86%)	818	0.15		
Hlaalua				420				
Kanakanavu			0	(100%)	420	0.07		
Total			261346	300394	561740	100		

# Re-scaled groups by population

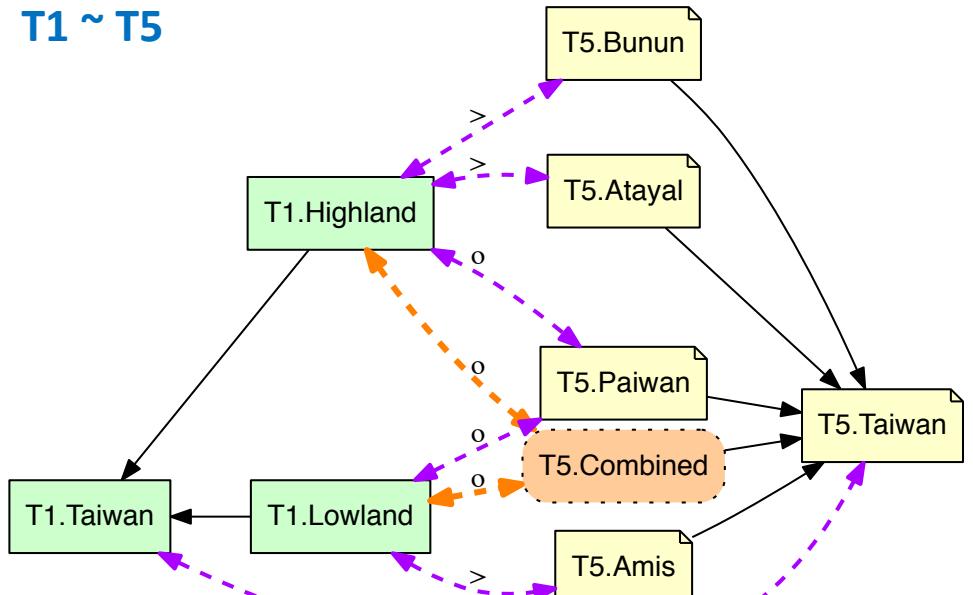


	Total	Percentage
Amis	213,810	38.06
Paiwan	102,931	18.32
<b>Combined</b>	93,152	16.58
Atayal	92,235	16.42
Bunun	59,612	10.61
<b>Total</b>	<b>561,740</b>	<b>100</b>

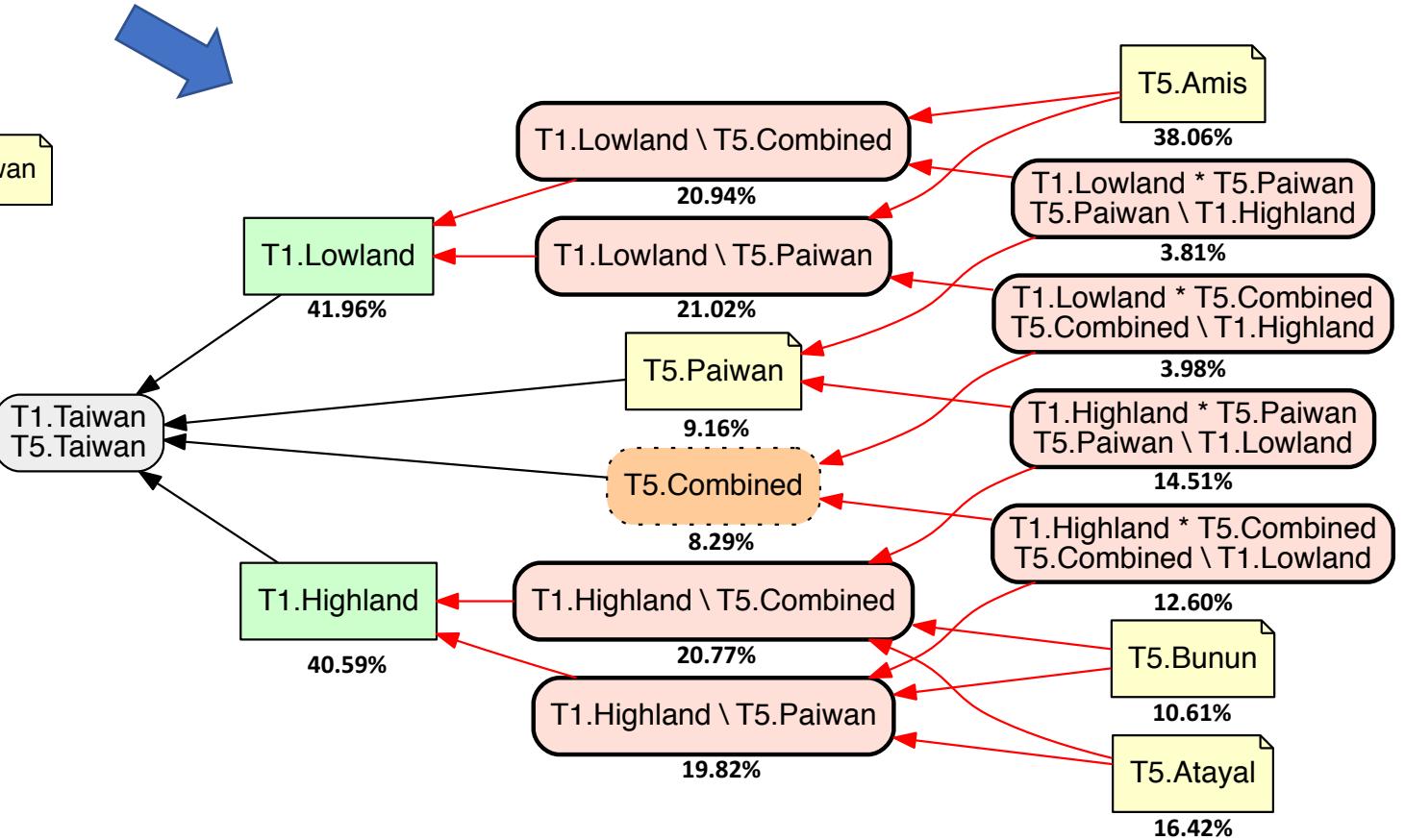
# Taxonomy Alignment Problem 4: T1.LH versus T5. 5 groups

**Input Taxonomies**

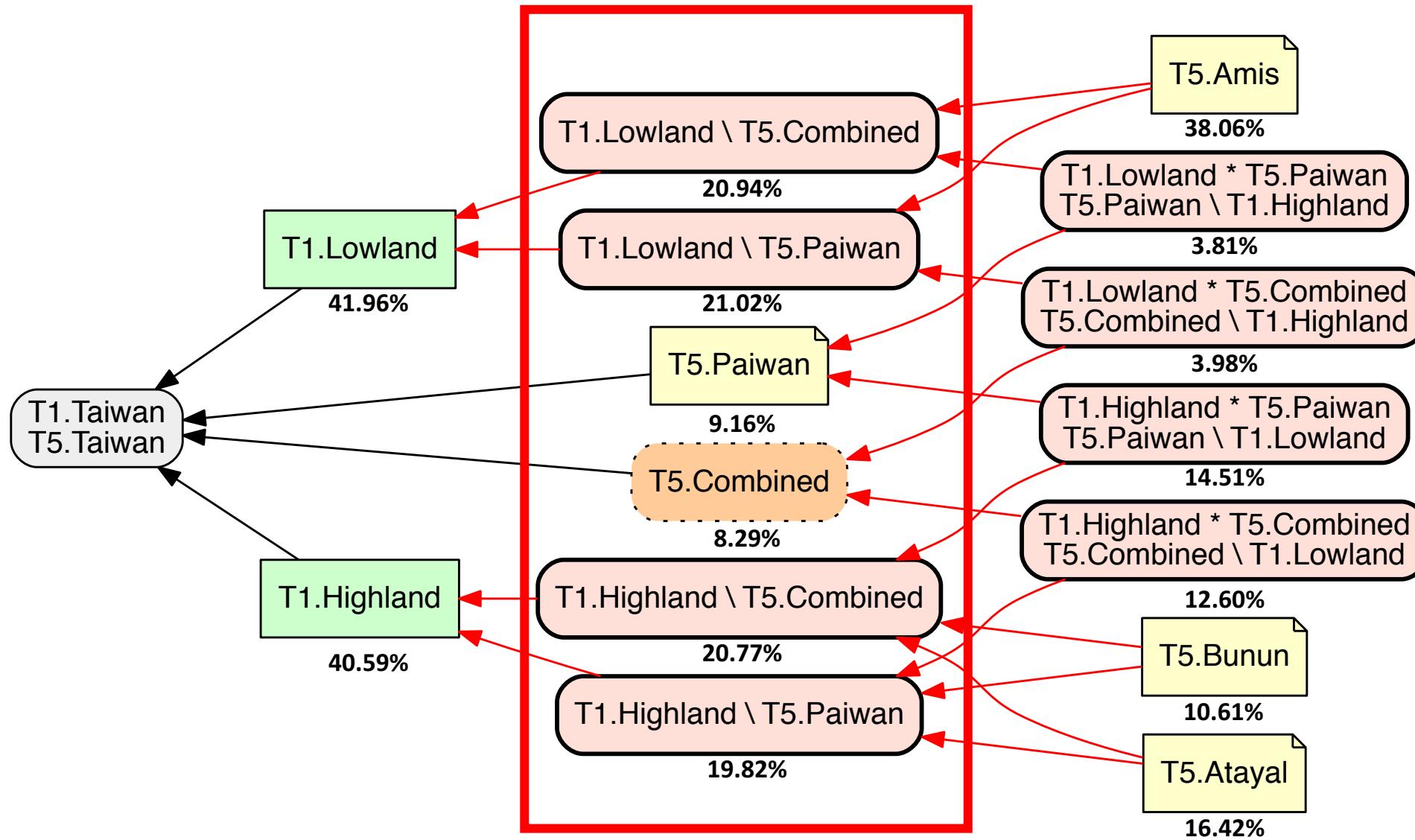
**T1 ~ T5**



**Merged PW**



# Taxonomy Alignment Problem 4: T1.LH versus T5. 5 groups



# Conclusion



- Embedded assumptions can be indicative not only in bibliographic classifications, but also in geopolitical taxonomies
- The number of recognized indigenous tribes is increasing, but the electoral constituencies remain static in a dichotomy from the 1940s until now
- The four Taxonomy Alignment Problems (TAP) we present in this study show that multiple viewpoints can coexist in the resulting merged taxonomy, or *Possible World(s)* (PW)

# Discussion



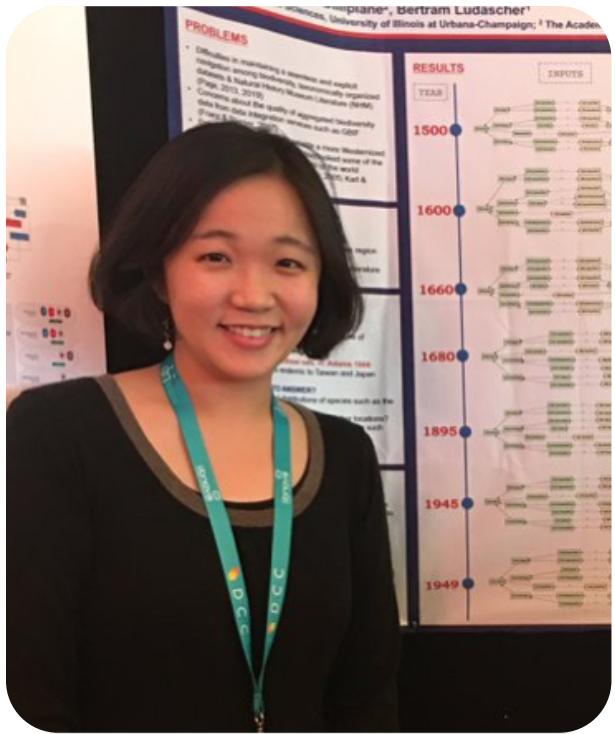
- All TAPs demonstrated in this study serve as options rather than optimal solutions to compare these taxonomies
  - more factors still need to be taken into account to form a more comprehensive merging problem
- Theoretical implications: Logic-based alignment approach's capability to display different perspectives in the merged solution
  - schema migration or KOSs versioning updates
- Practical implications: the results of TAP may be taken into account for policy-making in the future

# Acknowledgement



The first author would like to thank Dr. Inkyung Choi, Dr. Jacob Jett, and Ly Dinh for their kind feedback.

# Thank you! Any questions?



Jessica Yi-Yun Cheng  
@yiyunjessica



Bertram Ludäscher  
@ludaesch