

HANDLING PLURAL FORMS OF TELUGU WORDS IN MACHINE TRANSLATION

¹T. KAMESWARA RAO, ²T. ASHOK KUMAR, ³T. V. PRASAD

^{1,2}Assoc. Professor, Dept. of CSE, Chirala Engineering College, Chirala, AP, India

³Dean, Dept. of CSE, Chirala Engineering College, Chirala, AP, India

E-mail: ¹tkrphd@gmail.com, ²cecashok@gmail.com, ³tvprasad2002@yahoo.com

Abstract—Plurals of any language plays crucial role in day-to-day conversations. Any language cannot be imagined without plurals. More attention has to be given to plurals and their inflections in Machine Translation (MT) since they are not formed based on one predefined particular rule - especially in Telugu that is selected as the source language (SL). There are numerous categories of singulars. Various rules are employed to form their plurals.

Numerous types of plural forms and their formations of Telugu are discussed in this paper. Plural formation rules are discussed along with their colloquial forms. Some of the plural forms are formed beyond any logic and sometimes they used to form in accordance with usage of the people. Plurals and their inflections are discussed along with some of their popular colloquial forms. Obtaining plurals from their inflection forms for MT is discussed in this paper along with some of their popular colloquial plural inflections.

Index terms - Plurals, Inflections, Plural Inflections, Mt, Telugu Plural Forms.

I. INTRODUCTION

Plural means more than one entity in number [1]. Plural forms are very common in any natural language and can be formed for countable entities. To have plural forms for nouns and pronouns is a custom in all the languages. Sometimes verbs/ auxiliary verbs also have the plural forms, for instance, in English, 'are' is the plural form of 'is'.

Plural forms can be categorized into two types, viz. regular and irregular. Regular forms are formed according to the common grammar rules of language. Irregular forms are the special cases of the formations, sometimes against the grammar rules. Common man conversations can cause colloquial form of the plural, for e.g. in Telugu 'siMhAlu' (lions) is the colloquial form of 'siMhamulu' that is the correct plural of the singular 'siMhamu' (lion). Though the colloquial plural forms are discussed in this paper, they are not considered in Machine Translation.

In general, all the languages use plural forms to represent when there are two or more countable entities. Unlike all the other languages, Sanskrit employs dual form that specifically represents two entities; from three entities onwards, plural forms are employed to represent plurality. Sanskrit is a unique language with this nature [2] [4].

As the India is a multilingual country, there is high chance of influence of one language on another; especially the impact of Sanskrit on other languages is very high. In this contest, Telugu was originally intended to be totally free from the influence of Sanskrit. Later with passage of time, Telugu was heavily influenced by Sanskrit⁷. Telugu can be considered as a very rich language due to its enormous vocabulary and the ability to evince the moods and feelings more precisely than other languages of the sub-continent [8].

In any language, generally some entities are always plural and some entities do not have plural forms. Some entities will have two or more types of plural forms. All these cases are discussed in detail along with examples in later sections of this paper.

II. TYPES OF TELUGU PLURAL FORMS

Telugu is a well structured and rich language in terms of construction and expression [9]. As in all other languages, plural forms are common in Telugu also. Though many features are adapted from Sanskrit in to Telugu [3], dual forms are not adapted [5]. Unlike Sanskrit, Telugu uses only singular and plural forms like any other language. There are regular and irregular plural forms in Telugu also. Appending 'lu' to the entity is the regular phenomenon in Telugu to make plural forms [6]. But the plurals can be formed in many ways without any fixed predefined methodology since numerous exceptions are present.

1. Appending 'lu' to the singular that ends with 'mu' is the common procedure to form a plural in Telugu as in Table 1

Table 1. Plural forms of type - 1

Singular	Plural	Colloquial form
<i>dhanamu</i> (money)	<i>dhanamulu</i>	<i>dhanAlu</i>
<i>ibhamu</i> (elephant)	<i>ibhamulu</i>	<i>ibhAlu</i>
<i>Ojamu</i> (strength)	<i>Ojamulu</i>	<i>OjAlu</i>
<i>kacamu</i> (hair)	<i>Kacamulu</i>	<i>kacAlu</i>
<i>dinamu</i> (day)	<i>Dinamulu</i>	<i>dinAlu</i>
<i>siMhamu</i> (lion)	<i>siMhamulu</i>	<i>siMhAlu</i>
<i>mOmu</i> (face)	<i>mOmulu</i>	NA
<i>tUmu</i> (hole)	<i>tUmulu</i>	NA
<i>gAmu</i> (planet)	<i>gAmulu</i>	NA
<i>vEmu</i> (neem)	<i>vEmulu</i>	NA

Colloquial forms for the above type are formed only when singulars are ending with the pattern 'amu'.

2. Plural is formed by appending 'lu' to the singular that ends with a long vowel (i.e. 'A, I, U, E & O') as in Table 2.

Table 2. Plural forms of type - 2

Singular	Plural	Singular	Plural
paTTi (strip)	paTTilu	kaDDi (rod)	kaDDilu
kuMDi (vase)	kuMDilu	dANA (food)	dANalu
taMDA (tribe)	taMDAlu	TOPl (cap)	TOPlu

Colloquial forms will not be generated for this type

3(a) Plural can be formed by appending 'lu' if the singular is ended with 'ka/ku/ke' as in the table 3.

Table 3. Plural forms of type - 3(a)

Singular	Plural	Singular	Plural
ika (feather)	ikalu	nUka (grit)	nUkalu
alaka (anger)	alakalu	maraka(stain)	marakalu
mUka (crowd)	mUkalu	rUka (coin)	rUkalu
Aku (leaf)	Akulu	cAku (knife)	cAkulu
TAku (edge)	TAkulu	DOku (vomiting)	DOkulu
saraku (article)	sarakulu	baMku (lane)	baMkulu
ike (feather)	ikelu	oMke (hook)	oMkelu
plke(wind pipe)	plkelu	raMke (roar)	raMkelu
bOke (bone)	bOkelu	aMke (number)	aMkelu

3(b) Plural can be formed by replacing 'i' with 'ulu' if the singular is ended with 'ki/khi' as in the table 4.

Table 4. Plural forms of type - 3(b)

Singular	Plural	Singular	Plural
kAKi (crow)	kAKulu	sakhi (friend)	sakhulu
kaMKi (corn)	kaMKulu	kEKi (peacock)	kEKulu
bOKi (vessel)	bOKulu	ADhaki (peas)	ADhakulu
Elaki (cardamom)	Elakulu	kUKi (dove)	kUKulu

The plural forms of the singulars that ends with 'ga/gi/gu/ge/ca/ci/cu/ce/Ta/Ti/Te/Da/Di/Na/Ni/Nu/Ne ta/ti/tu/da/di/du/de/na/ni/nu/ne/pa/pi/pu/pe/ba/bi/bu/be/ma/mi/mu/me/ya/yu/ye/ra/ri/re/la/le/La/va/vi/vu/veSa/Si/Su/Se' follows rules described in 3(a) & (b)

3(c) There are some cases in which plurals can be formed by replacing 'i' with 'lu' if the singular is ended with 'Ti' as in the table 5.

Table 5. Plural forms of type - 3(c)

Singular	Plural	Singular	Plural
kOTi (crore)	kOTlu/ kOTulu	okaTi (one)	okaTlu/ okaTulu

3(d). Plurals can be formed by replacing 'Tu' with 'Tlu' if the singular ends in 'Tu' as in the table 6.

Table 6. Plural forms of type - 3(d)

Singular	Plural	Singular	Plural
baMTu (servant)	baMTlu	daMTu (stem)	daMTlu
kATu (bite)	kATlu	tUTu (hole)	tUTlu
pATu(mishap)	pATlu	pOTu (blow)	pOTlu
alavATu(habit)	alavATlu	UTu(wet)	UTlu
glTu (line)	glTlu	vETu (hit)	vETlu
auTu(cracker)	auTlu	cOTu (place)	cOTlu

3(e). It is a custom in Telugu to use 'LLu' instead of 'Dulu' in plural form if the singular is ended with 'Di' as in the table 7. But usage of 'LLu' leads to colloquial form.

Table 7. Plural forms of type - 3(e)

Singular	Plural
paccaDi (pickle)	paccaDulu / paccaLLu
savvaDi (noise)	savvaDulu / savvaLLu
gaDi (boundary)	gaDulu / gaLLu
uravaDi (swiftness)	uravaDulu / uravaLLu
muDi (knot)	muDulu / muLLu
baDi (school)	baDulu / baLLu
guDi (temple)	guDulu / guLLu
taDi (wet)	taDulu / taLLu

Note: Plural of the word 'kODi (hen)', is 'kOLLu'. There is no plural form as 'kODulu'. Similarly, plural form of 'IEDi (deer)' is 'IELLu'. There is no plural form 'IEDulu'.

3(f). Plurals can be formed by replacing 'MDi/MDu' with 'MDlu/LLu' if the singular is ended with 'MDi/MDu' as in the table 8. But usage of 'LLu' leads to colloquial form.

Table 8. Plural forms of 3(f)

Singular	Plural	Singular	Plural
baMDi (cart)	baMDlu/baL Lu	tiMDi (feast)	tiMDlu/tiLLu
ceMDu (ball)	ceMDlu/ ceLLu	beMDu (cork)	beMDlu/ beLLu
paMDu(fr uit)	paMDlu/paL Lu	diMDu (pillow)	diMDlu / diLLu

3(g). Plurals can be formed in majority of cases by replacing 'Du' with 'LLu' if the singular is ended

with 'Du'(should not be preceded with 'M') as in the table 9. Also there is a custom in Telugu to append 'lu' to 'Du' of singular to form its plural.

Table 9. Plural forms of type – 3(g)

Singular	Plural	Singular	Plural
<i>kADu</i> (grave)	<i>kADulu</i> / <i>kALLu</i>	<i>yEDu</i> (year)	<i>yEDulu</i> / <i>yELLu</i> / <i>yEMDlu</i> *
<i>kODu</i> (leg of cot)	<i>kODulu</i> / <i>kOLLu</i>	<i>kUDu</i> (food)	<i>kUDulu</i> / <i>kULLu</i>
<i>gUDu</i> (nest)	<i>gUDu</i> / <i>gULLu</i>	<i>tADu</i> (rope)	<i>tADulu</i> / <i>tALLu</i>
<i>mODu</i> (stump)	<i>mODulu</i> / <i>mOLLu</i>	<i>rAmuDu</i> (a king)	<i>rAmuDulu</i> / <i>rAmuLLu</i>

Following are the special cases in the category

- '*mAnavuDu*'(a human) - '*mAnavulu*'
- '*manavaDu*'(grandson) - '*manavalu*/ *manavaLLu*'
- '*yEDu*'(year)-'*yEMDlu*'

3(h). There is a custom in Telugu that 'nulu' in plural form can be diminished to 'nlu', because 'n' is known as 'druta' in Telugu grammar [3] and 'nu' can be diminished to 'n' under some special conditions. This is described in the table 10.

Table 10. Plural forms of type – 3(h)

Singular	Plural	Singular	Plural
<i>kolanu</i> (pond)	<i>kolanulu</i> / <i>kolanlu</i>	<i>bOnu</i> (cage)	<i>bOnulu</i> / <i>bOnlu</i>
<i>mAnu</i> (trunk)	<i>mAnulu</i> / <i>mAnlu</i>	<i>mlnu</i> (a fish)	<i>mlnulu</i> / <i>mlnlu</i>
<i>mEnu</i> (body)	<i>mEnulu</i> / <i>mEnlu</i>	<i>enu</i> (buffalo)	<i>enulu</i> / <i>enlu</i>

Note: There is a practice to write plural form of the word '*pEnu* (louse)', as '*pElu*' and plural form of '*cEnu* (field)' as '*cElu*'.

3(i) Plurals can be formed by appending 'lu' if the singular is ended with 'yi' as in the table 11.

Table 11. Plural forms of type – 3(i)

Singular	Plural	Singular	Plural
<i>kuLAyi</i> (tap)	<i>kuLAYilu</i>	<i>rUpAyi</i> (rupee)	<i>rUpAyilu</i>
<i>sthAyi</i> (steady)	<i>sthAyilu</i>	<i>dOyi</i> (pair)	<i>dOyilu</i>
<i>bakAyi</i> (due)	<i>bakAyilu</i>	<i>kasAyi</i> (butcher)	<i>kasAyilu</i>
<i>ilAyi</i> (torch)	<i>ilAyilu</i>	<i>dAyi</i> (nurse)	<i>dAyilu</i>
<i>tAyi</i> (mom)	<i>tAyilu</i>	<i>cuyi</i> (hiss)	<i>cuyilu</i>

3(j). There are special cases in formation of plural of the singular that ends with 'yi' as in the table 12.

Table 12. Plural forms of type – 3(j)

Singular	Plural	Singular	Plural
<i>nEyi</i> / <i>neyyi</i> (ghee)	<i>nEtulu</i>	<i>vEyi</i> / <i>veyyi</i> (thousand)	<i>vElu</i>
<i>anuyYi</i> (disciple)	<i>anuyUyulu</i>	<i>cEyi</i> (hand)	<i>cEtulu</i>
<i>nUyi</i> / <i>nuyyi</i> (well)	<i>nUtulu</i>	<i>rAyi</i> (stone)	<i>rALLu</i>

3(k). There are few modes of plurals of singular that ends with 'ru' as in the table 13. Preferably if the preceding letter of 'ru' is any long vowel, i.e. *A/I/U/E/O*, 'ru' is converted to '*rlu*/ *rulu*/ *LLu*' to form plural

Table 13. Plural forms of type – 3(k)

Singular	Plural	Remarks
<i>Uru</i> (town)	1. <i>Urlu</i> 2. <i>ULLu</i>	1. Replace 'ru' with 'ru'
<i>gOru</i> (nail)	1. <i>gOrlu</i> 2. <i>gOLLu</i>	2. Replace 'LLu' with 'ru' (colloquial form)
<i>nOru</i> (mouth)	1. <i>nOrlu</i> 2. <i>nOLLu</i>	
<i>Eru</i> (river)	1. <i>Erlu</i> 2. <i>Erlu</i>	1. 'lu' is appended
<i>SEru</i> (K.g)	1. <i>SErlu</i> 2. <i>SErlu</i>	2. Replace 'ru' with 'rlu'
<i>pEru</i> (name/ strip)	1. <i>pErlu</i> 2. <i>pErlu</i> 3. <i>pELLu</i>	1. 'lu' is appended 2. Replace 'ru' with 'rlu' 3. Replace 'ru' with 'LLu'

3(l). Plural can be formed by replacing '*li*/*lu*/*Li*/*Lu*' with '*LLu*' if the singular is ended with '*li*/*lu*/*Li*/*Lu*' as in the table 14.

Table 14. Plural forms of type – 3(l)

Singular	Plural	Singular	Plural
<i>pagalu</i> (day)	<i>pagaLLu</i>	<i>DAlu</i> (shield)	<i>DALLu</i>
<i>kAlu</i> (leg)	<i>kALLu</i>	<i>DOlu</i> (a drum)	<i>DOLLu</i>
<i>pAlu</i> (share)	<i>pALLu</i>	<i>Daulu</i> (pomp)	<i>DauLLu</i>
<i>asalu</i> (mud)	<i>asaLLu</i>	<i>tElu</i> (scorpion)	<i>tELLu</i>
<i>nUlu</i> (thread)	<i>nULLu</i>	<i>tOlu</i> (leather)	<i>tOLLu</i>
<i>cellelu</i> / <i>celli</i> (sister)	<i>celleLLu</i>	<i>kaMbaLi</i> (crinoline)	<i>kaMbaLLu</i>
<i>kIlLu</i> (joint)	<i>kILLu</i>	<i>rOlu</i> (mortar)	<i>rOLLu</i>
<i>kaulu</i> (agreement)	<i>kauLLu</i>	<i>vrElu</i> (finger)	<i>vrELLu</i>
<i>cUlu</i> (pregnancy)	<i>cULLu</i>	<i>pagulu</i> (crack)	<i>paguLLu</i>
<i>cAkali</i> (washer)	<i>cAkaLLu</i>	<i>mosali</i> (crocodile)	<i>mosaLLu</i>
<i>dAkali</i> (bowl)	<i>dAkaLLu</i>	<i>kaDali</i> (ocean)	<i>kaDaLLu</i>
<i>vAkili</i> (gate)	<i>vAkiLLu</i>	<i>nemali</i> (peacock)	<i>nemaLLu</i>
<i>nAgali</i> (plough)	<i>nAgaLLu</i>	<i>rOkali</i> (pestle)	<i>rOkaLLu</i>

3(m). Some of the plurals can be formed by replacing 'li' with 'lulu' for some singulars that ends with 'li' as in the table 15.

Table 15. Plural forms of type – 3(m)

Singular	Plural	Singular	Plural
<i>uli</i> (chisel)	<i>ululu</i>	<i>Oli</i> (dowry)	<i>Olulu</i>
<i>cali</i> (cool)	<i>calulu</i>	<i>bali</i> (sacrifice)	<i>balulu</i>
<i>celi</i> (friend)	<i>celulu</i>	<i>gAli</i> (wind)	<i>gAlulu</i>
<i>gili</i> (doubt)	<i>gilulu</i>	<i>puli</i> (tiger)	<i>pululu</i>
<i>poli</i> (sacrifice)	<i>polulu</i>	<i>Saili</i> (diction)	<i>Sailulu</i>
<i>aMjali</i> (offering)	<i>aMjalulu</i>	<i>Ali</i> (wife)	<i>Alulu</i>

4(a). Plural is formed by replacing second consonant from the twinned consonants (*dwittAksharamulu*) at the rear and its vowel in singular by 'lu' as in table 16. This is applicable only for the consonants 'T' and 'D' and for the vowels 'u' and 'i';

Table 16. Plural forms type – 4(a) ends with 'u/i'

Singular	Plural	Singular	Plural
ceTTu (tree)	ceTlu	ciTTi (vessel)	ciTlu
doDDi (yard)	doDlu	buDDi (toy)	buDlu
gruDDu(egg)	gruDlu	raDDu(kingdom)	raDlu
toTTi (tub)	toTlu	laDDu (sweet)	laDlu
jaTTu (team)	jaTlu	oDDu (bank)	oDlu

4(b). If the vowel (rear character) is 'a/e' in the case of 4(a), then plural can be formed by appending 'lu' as in the table 17.

Table 17 Plural forms fo type – 4(b) ends with 'e/a'

Singular	Plural	Singular	Plural
taTTa (basket)	taTTalu	peTTe (box)	peTTelu
baTTa (cloth)	baTTalu	tuTTe (lump)	tuTTelu
guDDa (cloth)	guDDalu	oDDe(digger)	oDDeLu
jiDDa(confusion)	jiDDalu	kaTTe (stick)	kaTTelu

4(c). For the remaining rear twinned consonants i.e. 'c,t,p,g,j,d,b,n,N,m,y,r,L,v,S,sh,s,h,l', plural is formed by appending 'lu' to the singular that ends with the vowels 'a', 'u' and 'e' as in tables 18, 19 & 20 respectively.

Table 18. Plurals of type 4(c), singulars ends with 'a'

Singular	Plural	Singular	Plural
pacca (emerald)	paccalu	anna (brother)	annalu
motta(edge)	mottalu	amma (mom)	ammalu
kuppa (heap)	kuppalu	ayya (father)	ayyalu
mogga (bud)	moggalu	karra (stick)	karralu
sajja (basket)	sajjalu	tavva (bowl)	tavvalu
gradda(eagle)	graddalu	biLLa (dollar)	biLLalu
Jabba (shoulder)	jabbalu	pilla (girl)	Pillalu

Table 19. Plurals of type 4(c), singular ends with 'u'

Singular	Plural	Singular	Plural
heccu (extra)	hecculu	kannu (eye)	kannulu
ettu (height)	ettulu	dammu (dare)	dammulu
tappu (false)	tappulu	karru (plough)	karrulu
daggu(cough)	daggulu	navvu(smile)	navvulu
gujju (stick)	gujjulu	tapassu (meditation)	tapassulu
eddu (ox)	edduLu	oLLu (body)*	oLLulu
jabbu(disease)	jabbulu	illu (house)	illulu

*A special case: 'oLLu' is a colloquial form of 'oDalu'. 'oLLulu' is also a colloquial form.

There is a custom in Telugu to write the plurals as follows

- Plural of 'puvvu'(flower) is 'pUlu' (colloquial form of 'puvvulu')
- Plural of 'illu'(house) is 'iLLu' (colloquial form of 'illulu')
- Plural of 'eddu'(ox) is 'eDlu' (colloquial form of 'edduLu')
- Plural of 'kannu'(eye) is 'kaLLu'(colloquial form of 'kannulu')

Table 20. Plurals of type 4(c), singular ends with 'e'

Singular	Plural	Singular	Plural
kacce (fight)	kaccelu	ginne (cup)	ginnelu
katte (lady)	kattelu	gumme(dent)	gummelu
kuppe(knob)	kuppelu	purre (skull)	purrelu
pagge (skill)	paggelu	divve (lamp)	divvelu
gajje (bell)	gajjelu	kaLLe(phlegm)	kaLLeLu
midde (roof)	middelulu	mulle (asset)	mullelu

4(d). If the twinned consonants of 4(c) end in the vowel 'i', then 'i' is replaced with 'ulu' to form plural as in the table 21.

Table 21. Plural forms of 4(d), ends with 'i'

Singular	Plural	Singular	Plural
jakki (horse)	jakkulu	kammi (rod)	kammulu
appacci(cake)	appacculu	nuyyi (well)	nuyyulu
katti (knife)	kattulu	verri (mad)	verrulu
noppi (pain)	noppulu	javvi (horse tail)	javvulu
aggi (fire)	aggulu	talli (mom)	tallulu
gajji (itch)	gajjulu	libbi (wealth)	libbulu
buddhi (sense)	buddhulu	peLLi (marriage)	peLLiLLu *

*a special case

For the word 'manishi' (man), there is a custom to write 'manushyulu' as a plural equal to 'manushulu', one more special case is 'peMDli' (marriage), its plural is 'peMDliLLu'. For non-possible combinations or patterns, examples are not given in the above tables.

5 (a). For some cases, 'ru' is used to form the plurals as in the Table 22.

Table 22. Plural forms of type 5 (a)

Singular	Plural
bAluDu (boy)	bAluru
kaMsAli (gold-smith)	kaMsAluru

5 (b). Plural can be formed for the singular that ends in 'rAlu/ gADu', by replacing 'lu/Du' with 'MDru' as in the table 23.

Table 23. Plural forms of type 5 (b)

Singular	Plural
nAyakurAlu (female leader)	nAyakurAMDru
guNavaMturAlu (wise lady)	guNavaMturAMDru
nEtagADu (a male weaver)	nEtagAMDru
sEdyagADu (a male servant)	sEdyagAMDru
pAlegADu (a male servant)	pAlegAMDru

But there is a custom to form plurals by replacing 'lu/Du' with 'LLu' instead of 'MDru' for the above patterns, for instance, 'nAyakurALLu/ bAliMtarALLu/ guNavaMturALLu/ manavarALLu/ nEtagALLu/ sEdyagALLu/ pAlegALLu' etc. But it can be considered colloquial.

- Majority of grain names are always represented in plural form. For example, 'kaMdulu (red-gram), pesalu (green-gram), minumulu (black-gram), gOdhumalu (wheat)' etc.
- Names of some games are always represented in plural form 'kaLLagaMtalulu / accanagAyalulu / OmanaguMtalulu / gujjena gULLu / kuppi geMtululu / dAguDu mUtalulu / biLLaMgOLLu' etc.
- Some twin words also always represented in plural form only. For example, 'daMpatulu' (wife and husband), 'tallidaMDrulu' (parents), etc.

III. HANDLING INFLECTED PLURALS IN MT

Modification of a word to express various tenses, voices, moods, numbers, genders, persons, etc. is known as inflection ('vibhakti') [10]. Declension is the inflection of nouns, pronouns and adjectives. Conjugation is the inflection of verbs [11]. Inflections take place at the rear end of words. Since every word is an inflection of a root verb ('dhAtu') in Sanskrit, conjugations are possible in Sanskrit but not in Telugu [12]. As per the grammar, there are eight inflections in Telugu as described in table 24. Eighth inflection is less significant.

Table 24. Inflections/Declensions

Vibhakti	Type	Types of Declensions
prathamA	Nominative	Du mu vu lu
dvitIyA	Accusative	ni nu lanu kUrci guriMci
tRtIyA	Instrumental	cEta cE tODa tO
caturthI	Dative	koraku kY
paMcaml	Ablative	valana kaMTe paTTi
shashTI	Possessive	ki ku yokka IO IOpala
saptaml	Locative	aMdu na
saMbOdhana prathamA	Vocative	Orl Osl Oyl hE etc are prefixed to the Nominatives

Table 25. Solutions to obtain the plurals from inflected plurals.

Observation	Methods
la+inflection	1. Replace observation with 'lu'
LLa+inflection	2. Replace observation with 'LLu'
ra +inflection	3. Replace observation with 'ru'
l+inflection (colloquial)	4. Replace observation with 'lu'

1. Handling Nominatives: Regular phenomenon to form a plural in Telugu is to append 'lu' to the nominative singular [13] (various modes of plural formations are discussed in section 2 in this paper).

In MT, when 'lu' is observed at the rear end of a phrase, it should not be considered slavishly as a plural phrase initially because ending in 'lu' for many singulars in Telugu is a usual phenomenon, e.g., 'amalu (execution)'. The phrase must be searched in the database as it is. The phrase can be translated if it is available in database. Otherwise it may be considered as a plural. To obtain the singular from various types of plurals (see the tables from Table 1 to Table 23) procedures in Table 26 can be applied. Obtained singular will be translated into DL and should be modified as a plural according to DL rules.

Table 26. Obtaining singular from plural nominatives

Plural Type	Observation	To obtain singular
1	Alu	Replace with 'amu'
3b, 4d, 3c	ulu	Replace with 'i'
3d,	Thu	Replace with 'Tu'
3f,	MDlu	Replace with 'MDi'
3h,	nulu/nlu	Replace with 'nu'
3k	rlu	Replace with 'ru'
3m	lulu	Replace with 'li'
4a	Thu	Replace with 'TTi/TTu'
4a	Dlu	Replace with 'DDi/ DDU'
5a	uru	Replace with 'Du/i'
5b	AMDru	Replace with 'Alu/ADu'
3e,3f,3g,3k,3l	LLu	Replace with 'Di/ Du/ ru/ lu/ MDi/ li/ nnu/ yi'
5b	ALLu	Replace with 'Alu/ADu'
1,2,3a&i, 4b & c, 3c	lu	Omit 'lu'/Replace with 'i'
3e, 3g	Dulu	Replace with 'Di/Du'
3j	yulu/tulu	Replace with 'yyi/yi'

Following the rules mentioned in above table to obtain singulars from the plurals in MT, may not give suitable singulars, e.g. for the plural 'kOLLu', 'LLu' can be replaced with either 'Di/Du'. If 'LLu' is replaced with 'Di', 'kODi' (hen) can be formed or if it is replaced with 'Du', 'kODu' (leg of a cot) is formed. Both are meaningful. This ambiguity is because of the way the phrase formed.

2. Handling Accusatives: Accusative inflections are of five types in Telugu viz. 'ni(n), nu(n), lanu, kUrci, gUrci/guriMci'. Tables 27 & 28 describe the ways of formations of accusative plurals. Transforming kUrci to gUrci to append is a grammatical rule in Telugu. gUriMci is synonym of gUrci.

Table 27. Plural accusatives with 'ni(n)/nu(n)/lanu'

Accusative Plural Type	Observation	Method
dhanamulan[i/u], mOmulan[i/u], paTTIlan[i/u], lKalan[i/u]	lani / lanu /	1
pagaLLan[i/u], kALLan[i/u], manavarALLan[i/u], rALLan[i/u], cAkaLLan[i/u], kOLLan[i/u]	LLani / LLanu	2
bAluran[i/u], kaMsAluran[i/u], pAlegAMDran[i/u]	rani/ ranu	3
dhanAlni, siMhAlni, kukkalni	lni	4

Table 28. Plural accusatives with 'gUrci/guriMci'

Accusative Plural Type	Observation	Method
vanamulan[i/u]gUrci, mOmulan[i/u]gUrci, lKalan[i/u]guriMci	lan[i/u]gUrci / lan[i/u]guriMci	1
pagaLLan[i/u]gUrci, rALLan[i/u]gUrci, kOLLan[i/u]guriMci	LLan[i/u]guriMci / LLan[i/u]gUrci	2
bAluran[i/u]guriMci, kaMsAluran[i/u]gUrci, nEtagAMDran[i/u]gUrci	ran[i/u]gUrci / ran[i/u]guriMci/ rniguriMci	3
dhanAlniguriMci, siMhAlnigUrci, rAjulniguriMci	lni[guriMci/ guriMci]	4

3. Handling Instrumentals: Instrumental inflections are of four types, viz. 'cEta, cE, tODa, tO'. Table 29 describes the ways of formations of instrumental plurals. Here 'cEta' is the synonym of 'cE' and 'tODa' is synonym of 'tO'

Table 29. Plural instrumentals with 'cEta(n), cE(n), tODa(n), tO(n)'

Instrumental Plural Type	Observation	Method
dhanamulacE(ta), pululacE(ta), kAkulatO(Da), kammulatO(Da)	lacE(ta) / latO(Da)	1
rALLatO(Da), kOLLacE(ta), kALLatO(Da), tELLacE(ta)	LLacE(ta) / LLatO(Da)	2
kaMsAluracE(Ta), bAluratO(Da), sAlegAMDracE(ta)	racE(ta) / ratO(Da)	3
kaMkulcE(ta), kaMkultO(Da), tOkalacE(ta), nEtaLcE(ta)	lcE(ta) / ltO(Da)	4

4. Handling Datives: Dative inflections are of two types, viz. 'koraku(n), kY'. Table 30 describes the ways of formations of dative plurals.

Table 30. Plural datives with 'koraku(n),kY'

Dative Plural Type	Observation	Method
Dhanamulakorak[u/Y], baMTIakorak[u/Y]	lakorak[u/Y]	1
paccaLLakorak[u/Y], rALLakorak[u/Y]	LLakorak[u/Y]	2
bAlurakora(ku/kY), sAlegAMDrakora(ku/kY), kamsAlurakora(ku/kY)	rakorak[u/Y]	3

5. Handling Ablatives: Ablative inflections are of three types, viz. 'valana(n),kaMTe(n),paTTi'. Table 31 describes the ways of formations of ablative plurals. Transforming paTTi to baTTi to append is a grammatical rule in Telugu. Mostly used colloquial form of 'valana' is 'valla'.

Table 31. Plural ablatives with 'valana(n), kaMTe(n), paTTi'

Ablative Plural Type	Observation	Method
dhanamulavalana, siMhAlavalla	lavalana/ lavalla	1
paccaLLavalana, rALLavalla, kOLLavalana	LLavalana/ LLavalla	2
bAluravalana, nEtagAMDravalla	ravalana / ravalla	3
pAmulakaMTe, gAlAlakaMTe	lakaMTe	1
rOLLakaMTe, kOLLakaMTe	LLakaMTe	2
bAlurakaMTe, kaMsAlurakaMTe	rakaMTe	3
pAmulabaTTi, siMhAlabaTTi	labaTTi	1
rOkalLabaTTi, ALLabaTTi	LLabaTTi	2
bAlurabaTTi, sAlegAMDraabaTTi,	rabatTTi	3
pAmulan[u/i]baTTi, siMhAlan[u/i]baTTi	lan[u/i]baTTi	1
paccaLLan[u/i]baTTi, rALLan[u/i]baTTi	LLan[u/i]baTTi	2
bAluran[u/i]baTTi, sAlegAMDran[u/i]baTTi	ran[u/i]baTTi	3
cEtuln[u/i]baTTi, snEhAln[u/i]baTTi	ln[u/i]baTTi	1

6. Handling Possessives: Possessive (also known as Genitive) inflections are of two types, viz. '*ki(n),ku(n), yokka, IO(n), IOpala(n)*'. Table 32 describes the ways of formations of possessive plurals. '*ki*' is the synonym to '*ku*'. '*ki*' is applied to the phrase that ends with '*i*' but no plural ends in '*i*'. '*IO*' is the synonym of '*IOpala*'.

Table 32. Plural possessives with '*valana(n), kaMTe(n), paTTi*'

Possessive Plural Type	Observation	Method
<i>dhanamulak[u/i], jagAlak[u/i], cElak[u/i]</i>	<i>lak[u/i]</i>	1
<i>kALLak[u/i], mosaLLak[u/i] rALLak[u/i], tELLak[u/i]</i>	<i>LLak[u/i]</i>	2
<i>bAlurak[u/i], sEdyagAMDraK[u/i]</i>	<i>rak[u/i]</i>	3
<i>jAtulayokka, cEpalayokka</i>	<i>Layokka</i>	1
<i>kOLLayokka, nemaLLayokka mosaLLayokka, rALLayokka</i>	<i>LLayokka</i>	2
<i>bAlurayokka, nAyakurAMDraYokka</i>	<i>rayokka</i>	3
<i>bAtulalO(pala), nitulalO(pala)</i>	<i>lalO(pala)</i>	1
<i>nILLalO(pala), kALLalO(pala) lELLalO(pala), iLLalO(pala)</i>	<i>LLalO(pala)</i>	2
<i>bAluralO(pala), bAliMtarAMDralO(pala)</i>	<i>ralO(pala)</i>	3
<i>kAkullo(pala), Enugullo(pala), cUpullo(pala), mEkullo(pala)</i>	<i>llo(pala)</i>	4

7. Handling Locatives: Locative inflections are of two types, viz. '*aMdu, na(n)*'. From these two locatives, generally, '*na*' cannot be seen with much importance. Combining both the locatives to form '*aMduna*' will not change the meaning if it is not connected with verb. If '*amduna*' is connected with a verb, it will give the meaning of '*aMduvalana* (because)'. For example, '*tinnanduna* (because of eating)'. Transforming '*aMdu*' to '*yaMdu*' is as per grammatical rules of Telugu. Table 33 describes the ways of formations of locative plurals.

Table 33. Plural locatives with '*aMdu, na(n)*'

Locative Plural Type	Observation	Method
<i>jAmula(ya)Mdu(na), pUla(ya)Mdu(na)</i>	<i>la(ya)Mdu(na)</i>	1
<i>aMgaLLa(ya)Mdu(na), rALLa(ya)Mdu(na)</i>	<i>LLa(ya)Mdu(na)</i>	2
<i>bAlura(ya)Mdu(na), nEtagAMDra(ya)Mdu(na)</i>	<i>ra(ya)Mdu(na)</i>	3

8. Handling Vocatives: All addressing / calling phrases will come under this category. These are available as separate phrases from the sentences. To handle vocatives in MT, it's better to maintain all vocatives in database as they appear as pre-positions, for e.g. '*ORi abbAyI*' (hey boy).

Note 1: From the above tables, the characters given in the parenthesis are optional and the choices given in square brackets are to be chosen any one.

Note 2: In the process of obtaining plural from the inflected plural, observation and its replacement is mentioned in the above tables. Inflection has to be extracted from the observation part and it should be preserved. The TL plural form must be subjected to the inflection as per the TL grammar rules.

CONCLUSION

Many methods have been discussed in this paper to obtain a) singulars from plurals and b) plural from the inflections. In addition to these known methods, certain more would find place to give accurate and abundant results in Telugu MT to any language. Due to heavy corruption of Telugu plurals and induction of colloquial words, the complexity of SL raised manifold. This corruption has given way to multiple forms of the same word.

Some of the plurals can create ambiguity in MT in deciding their root singular form. For example '*kALLu*' is the plural form of '*kADu* (graveyard)', '*kADi* (yoke)', and '*kAlu* (leg)'. Another example is '*kOLLu*', that can be the plural form of '*kODu* (a leg of a cot)' and '*kODi* (a hen)'. Context should be maintained to decide the root singular for the plural in such instances. There are numerous examples of this kind. Though there is a high chance of uncertainty in MT in the circumstances mentioned above, considerable number of plurals of SL can be translated into TL using the above methods with less human-intervention.

REFERENCES

- [1] Dr. K. Mallareddy, "Problems in Machine Translation in the Globalized Context – An Example of Plural Formation in Telugu Comparison with English", Int. Seminar on Globalization Telugu Language Literature and Culture, 25 & 26 February 2014.
- [2] Dr. Samudrala Venkata Ranga Ramanujacharya, "Samskruta Vani", Rohini Publications, 1997.
- [3] Kambhampati Ramagopala Krishnamurti, "Telugu Vyaakaranamu", Sri Sailaja Publications, 1991.
- [4] Arthur. A. McDonell, "Sanskrit Grammar for Students", 3rd Edition, Oxford University Press, 1926.
- [5] Divakarla Venkata Avadhani, "Telugu in Thirty Days", Andhra Pradesh Sahithya Academy, 1976.
- [6] A.H. Arden, "A Progressive Grammar of the Telugu Language", 2nd Edition, Society for promoting Christian Knowledge, Madras, 1905.
- [7] T. Kameswara Rao and Dr. T. V. Prasad, "Key Issues in Vowel based Splitting of Telugu Bigrams", Int. J. of Adv. Computer Sc. App., Vol. 5, No. 3, 2014.

- [8] T. Kameswara Rao and Dr. T. V. Prasad, "Telugu Bigram Splitting using Consonant-based and Phrase-based Splitting", Int. J. of Adv. Comp. Sc. App., Vol. 5, No. 5, 2014.
- [9] T. V. Prasad and G. Mayil Muthukumaran, "Telugu to English Translation Using Direct Machine Translation Approach", Int. J. of Sc. & Engg. Investigations, Vol.2 Issue 12, Jan 2012.
- [10] Jasti Suryanarayana, "Sanskrit for Telugu Students", Sri Balaji Printers, 1993.
- [11] Madhav M. Deshpande, "A Sanskrit Primer", University of Michigan, 2007.
- [12] K. L. V. Sastry and Pt. L. Ananta Rama Sastri, "Sabda Manjari", R. S. Vadhyar publishers, 2002.
- [13] Malladi Krishna Prasad, "Telugu Vyakaranamu", Victory publishers, Vijayawada.

★ ★ ★