



Georgian verb database: applying conjugation rules with exceptions

(Present and Future Tenses)

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Abstract

In Nowadays world, learning foreign language is becoming increasingly important and there are many who want to study Georgian language perfectly. There are web pages in the Internet where we can see the meaning of the word in Georgian, but when you want to learn Georgian language , which is a difficult language, there is a problem and especially with the verbs.

Application of Georgian verbs database is an application of Sewelis dedicated to English and French speaking persons who want to learn the Georgian language, verbs in grammatically (Sewelis stands for Semantic Web logical Information Systems).

Verb conjugation is quite hard, in particular for people not used to have markers concatenated before words. Proverbs are also difficult to work out, especially as they are only used at certain tenses. As a result, learners have great difficulties to find verbs in a regular dictionary.

With this application users have possibility to easily see the verb information, such as Tense, Preverb, English infinitive, Post radical, Georgian form, French Infinitive, Georgian Infinitive, Root, Pre radical, ending.

Keywords: Data mining, morphology.

რეზიუმე

თანამედროვე სამაროში სულ უფრო აქტუალური ხდება უცხო ენის შესწავლა და მათ შორის ძალიან ბევრი მსურველია რომელთაც სურთ ქართული ენის სრულყოფილად შესწავლა. ინტერნეტში არსებობს ვებ-გვერდები, სადაც შეგვიძლია ვნახოთ სიტყვის მნიშვნელობა ქართულ ენაზე, მაგრამ როდესაც სურთ ქართულის შესწავლა, რომელიც საკმაოდ რთული ენაა, გარკვეული პრობლემა ექმნებათ ზმნებთან დაკავშირებით. არსებობს საიტი, რომელიც ინგლისურად და ფრანგულად მოსაუბრე ადამიანებ დაეხმარებათ ქართული ენის, ზმნების გრამატიკულად შესწავლაში. როგორც ვიცით ზმნის უღლება არ არის მარტივი პროცესი და არც ზმინისწინის განსაზღვრა, რომელიც მხოლოდ გარკვეულ დროში გამოიყენება. ეს აპლიკაცია დაეხმარებათ მათ მათივად მოძებნონ ზმნა შესაბამის დროში. ამ აპლიკაციის საშუალებით მომხმარებელი ნახავს ზმნის შესახებ ზუსტ ინფორმაციას, რომელიც ეხება დროს, პირს, სუფიქს, პრეფიქს, ფუძეს, ინგლისურ და ფრანგულ შესატყვის, თუ როგორ ხდება ზმნის უღლება და ა.შ.

Contents

Acknowledgments	3
Abstract	4
1. Introduction	8
1.1 Project context.....	8
1.2 Project introduction.....	13
2. Present Tense	15
2.1 Present Tense, Group1.....	16
2.2 Present Tense, Group2	18
2.3 Present Tense, Group 3.....	20
2.4 Present Tense, Group 4.....	24
2.5 Exceptions of Present tense.....	27
3 Future Tense	28
3.1 Future tense. (Group1 & Group3).....	30
3.1.1 Exceptions of Future tense:.....	32
3.2 Future Tense (Group2& Group4)	33
3.1.2 Exceptions of Future tense:.....	33
5. Prolog	34
6. Conclusion	36
References.....	37

Figure 1-Georgian verb database interface	9
Figure 2- information about verb	10
Figure 3- conjugation of verb	13
Figure 4- Georgian Chars.....	14
Figure 5- Present tense [1]	15
Figure 6- exceptions in Present tense	27
Figure 7- future tense [1].....	29
Figure 8-Exceptions in Future Tense	32
Figure 9- Exceptions in Future Tense group2&group4.....	33
Figure 10-Imperfect tense	<i>Error! Bookmark not defined.</i>

1. Introduction

1.1 Project context

Georgian language belongs to the Kartvelian family. Georgian grammar is very different and hard from European languages and has many distinct features, such as split ergativity and a polypersonal verb agreement system and as we know Georgian has its own alphabet. In this research we will talk about the Georgian verbs. The Georgian verbal system is extremely complex, especially when compared to those of most Indo-European languages. Rather than using the terms "tense", "aspect", "mood", etc. Verbs are traditionally divided into four classes: transitive verbs, intransitive verbs, verbs with no transitive counterparts (medial verbs) and indirect verbs. There are numerous irregular verbs in Georgian, but they all belong to one of these classes. Each class uses different strategies to build the verb complex, irregular verbs employing somewhat different formations. Transitive verbs - Class 1 verbs generally have a subject and a direct object. Some examples are "eat", "kill" and "receive". Intransitive verbs only have a subject and no direct object (though a few govern an indirect object marked simply with the dative case). Most verbs in this class have a subject that does not perform or control the action of the verb (for example, "die", "happen"). Medial verbs Verbs in Class 3 are usually intransitive verbs, but unlike Class 2 verbs, they mark their subject using the ergative case. Most verbs of motion (such as "swim" and "roll") and verbs about weather (such as "rain" and "snow") belong to this class. Indirect verbs Verbs that convey the meaning of emotion and prolonged state belong to this class. The verbs "want" and "can" also belong to this class. Other common examples of Class 4 verbs are "sleep", "miss", "envy" and "believe". Stative verbs do not constitute a class *per se*, but rather refer to a state, and their conjugations are very similar to those of indirect verbs. For example, when one says, "the picture is hanging on the wall", the equivalent of "hang" is a stative verb. There are numerous irregular verbs in Georgian; most of them employ the conjugation system of Class 2 intransitive verbs. Irregular verbs use different stems in different screeves, and their conjugations deviate from the conjugations of regular intransitive verbs. Some irregular verbs are: "be", "come", "say", "tell" and "give". Georgian is an agglutinating language. Agglutination means that affixes each express a single meaning, and they usually do not merge with each other or affect each other phonologically.[3]

As mentioned to learn Georgian language is very difficult and particularly conjugation of verbs. In the internet are many sites, which help people to translate word from one language to another one. This technology is known as Machine translation, which is a sub-field of computational linguistics that investigates the use of software to translate text or speech from one language to another. Current machine translation software often allows for customization by domain or profession (such as weather reports), improving output by limiting the scope of allowable substitutions. This technique is particularly effective in domains where formal or formulaic language is used. It follows that machine translation of government and legal documents more readily produces usable output than conversation or less standardized text. But translation in many cases are not appropriate, for example when we want to translate word from English to Georgian. There are a lot of problems of Georgian translation. So, Georgian verb application is best solution where you can see exact translation of the verb in Georgian language.

Georgian verb database is a Collaborative project of INSA-IRISA-SemLIS Team:

Georgian verb database: <http://www.irisa.fr/LIS/ferre/sewelis-servolis/>

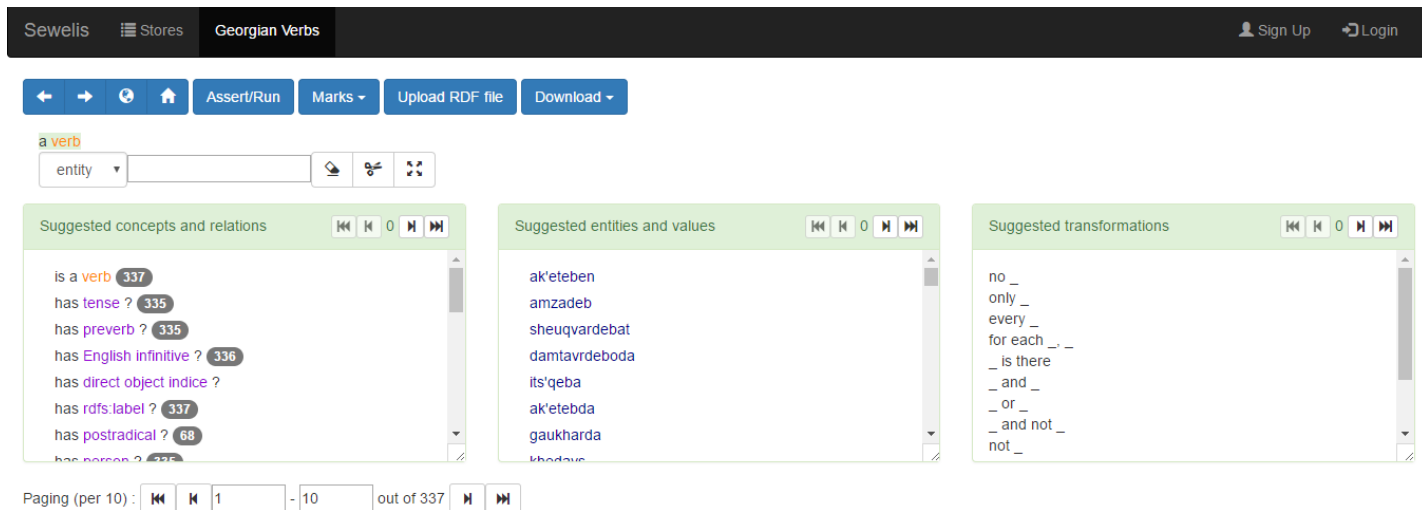


Figure 1-Georgian verb database interface

In this database are 337 Georgian conjugated forms of verbs and information about these verbs, such as: Person, Tense, Preverb, English infinitive, French infinitive, Georgian infinitive, Root, PFSF(present/future stem formant), prefix, suffix,ending.

For example: we can choose verb “amzadeb” and see relevant Tense, English infinitive, French infinitive, person and etc.

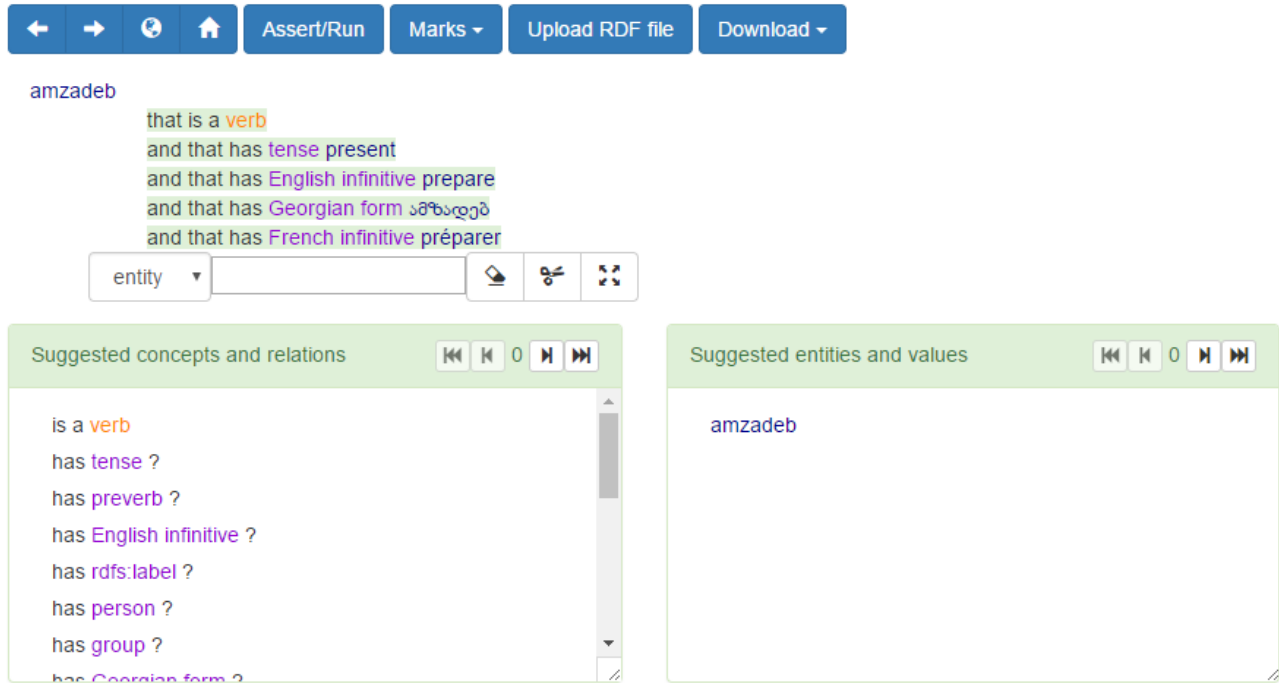


Figure 2- information about verb

Application Georgian verbs is for English and French speaking persons who want to learn the Georgian language. Learning the Georgian Verbs is very difficult. The more you master it the more you get closer to mastering the Georgian language. But first we need to know what the role of Verbs is in the structure of the grammar in Georgian. Georgian verbs are words that convey action (bring, read, walk, run), or a state of being (exist, stand). In most languages a verb may agree with the person, gender, and/or number of some of its arguments, such as its subject, or object. In general the Georgian verb is conjugated according to series. Moreover, the Georgian verb expresses the subject and object within the verb itself, which makes the Georgian verb distinguishable from other languages. This is why the Georgian grammar is complicated and that's why each raw and series should be learnt. Verbs in the present past and future tense have a very important role in Georgian.

We can see information about INSA, IRISA and TSU Universities and also SemLIS.

The National Institute of Applied Sciences of Rennes or INSA is a Grande Ecole of Engineers, a School of Engineering, under the authority of the French Ministry of Education and Research and part of the INSA's group.

Created in 1966, INSA Rennes is a member of the INSA Group, the leading French network of state graduate and post graduate engineering schools, composed of 6 schools in France, 7 partner schools and 1 international INSA in Morocco.

Research and innovation are the key elements of INSA training, which benefits from the expertise of its 130 professors and lecturers. With six laboratories of international renown, three technological platforms and numerous industrial partners, INSA Rennes stands out for two poles of excellence: Information & Communication Science & Technologies / Materials, Structures & Mechanics.

IRISA - (Institute for Research in Computer Science and Random Systems), founded in 1975, is a joint research center for Informatics, including Robotics and Image and Signal Processing. On these themes, Irisa is positioned as the premier research laboratory in Brittany with campuses in Rennes (35), Vannes (56), Lannion (22), and Brest (29).

750 people, 40 teams, 7 departments (Large Scale Systems/Networks, telecommunications and services/Language and Software Engineering/Digital signals and imaging, robotics/Media and communications/Data and knowledge management) explore the world of digital sciences to find applications in healthcare, ecology-environment, cyber-security, transportation, multimedia, and Industry.

TSU- The first-ever national university in the Caucasus was opened in 1918 laying the foundation for a European-type higher school in Georgia, based on Georgian educational traditions. Today the Ivane Javakhishvili Tbilisi State University is one of the first scientific-research institutions of Georgia. It implements about 200 local and international scientific grant programs annually.

The Tbilisi State University is one of the largest higher educational institutions by its scales. Today about 22 thousand students are undergoing studies at seven faculties of TSU.

Along with bachelors, masters and doctoral degree programs, the Tbilisi State University also implements higher vocational education, as well as short and long term certification programs. Based on close cooperation with foreign universities, Georgian students have opportunities to participate in exchange and joint international educational programs and gain double academic degrees.

LIS >>>

SemLIS - Semantics, Logics, Information Systems for Data-User Interaction.

The main objective of the SemLIS team is to bring the power to their data.

It aims at facilitating data-user interaction by making users more autonomous and agile, by providing flexibility and expressivity, and yet control and confidence in the information system. It should support users in the semantic representation of heterogeneous data, and in the collaborative acquisition of domain knowledge.

Sewelis - a LIS for the Semantic web, which stands for Semantic Web Logical Information System. Sewelis is an open source software under GPL license. Faceted search and querying are the two main paradigms to search the Semantic Web. Querying languages, such as SPARQL, offer expressive means for searching knowledge bases, but they are difficult to use. Query assistants help users to write well-formed queries, but they do not prevent empty results. Faceted search supports exploratory search, i.e., guided navigation that returns rich feedbacks to users, and prevents them to fall in dead-ends (empty results). However, faceted search systems do not offer the same expressiveness as query languages. We introduce query-based semantic faceted search, the combination of an expressive query language and faceted search to reconcile the two paradigms. A prototype, Sewelis has been implemented, and a usability evaluation demonstrated that semantic faceted search retains the ease-of-use of faceted search, and enables users to build complex queries with little training.

1.2 Project introduction

As for context of internship I am at INSA with Erasmus Plus program, where I'm working on my master thesis, which I mentioned is connected in Georgian verbs.

The project consists of producing conjugated forms of Georgian verbs. The objective is to fill the Sewelis pages. From a practical point of view, the aim is to develop a dedicated web interface on top of Formulis [2] that will help learners extend the database by mining and applying conjugation rules with exceptions. When new conjugated forms are entered, completion in terms of persons and tenses will be suggested, then the user could validate or modify them, then existing rules would be updated, and new rules could be mined.

The conjugation of verbs is divided into four groups and 14 subgroups (sg). Rules and examples are taken from the books of Nana Shavtvaladze, "Georgian Language for English Speakers", named "Biliki" [1]. There are no rules or examples for subgroups 12 and 13 in books II and III.

I Group	II Group	III Group	IV Group
N1 – stem -ობ (ob)	N7 მ(m) – stem -	N9 – stem- ები (ebi)	N14-
N2 – stem -ებ (eb)	გ(g) – stem -	N10 – stem- დები (debi)	
N3 – stem -ამ (am)	ო,ჰ,ბ(I,h,s) – stem -	N11 ი (i) – stem- ები (ebi)	
N4 – stem -ავ (av)	N8 მო(mi)- stem-	N12 ე(e) – stem- ები (ebi)	N15-
N5 – stem -ო (i)	გო(gi)- stem-	N13– stem- ია (ia)	
N6 – stem -ო (0)	უ(u)- stem-		

Figure 3- conjugation of verb

G1 group includes the following subgroups from sg1 to sg6 and covers most regular verbs. G2 group includes the following subgroups sg7 and sg8, also most verbs are regular verbs, but we have

exceptions, some verbs need own conjugation rules. G3 group includes the following subgroups from sg9 to sg13, but in this book [1] are not rules or examples for subgroups 12 and 13, and covers most regular verbs. As for G4 includes the following subgroup sg14, almost all verbs are irregulars and need own conjugation rules. Also in this group we added new subgroup 15, because all verbs (belonging to the 14 sg, according to the book [1]), that are in this subgroups requires a completely different set of rules to conjugation the verb.

According this book [1] the verb consist of the following parts: preverb, preradical, root, pfsf, postradical, ending, etc. For example: verb is in present tense, singular and third person: აუკმეbs - aukmebs (abolish). In this case:

- a (ა)- preradical
- ukm (უკმ)- root
- eb (ებ)- PFSF
- s (ს)- ending.

This is a table about Georgian chars, how to write Georgian letters. I use this type of letters for Prolog.

<u>Georgian</u>	ა	ბ	გ	დ	ე	ვ	ზ	თ	ი
ascii	a	b	g	d	e	v	z	t	i
<u>Georgian</u>	კ	ლ	მ	ნ	ო	პ	ჯ	რ	ს
ascii	K	l	m	n	o	P	j	r	s
<u>Georgian</u>	ტ	უ	ფ	ქ	ღ	ყ	შ	ჩ	ც
ascii	T	u	p	k	<u>gh</u>	Q	sh	<u>tch</u>	<u>ts</u>
<u>Georgian</u>	ძ	წ	ჭ	ხ	ჯ	ჰ			
ascii	dz	TS	TCH	<u>kh</u>	dj	h			

Figure 4- Georgian Chars

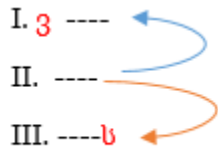
2. Present Tense.

Present Indicative is the simple present tense, it can be mostly the equivalent of present continuous in English, and it shows what the subject is doing now, at the moment. Its question is რას შვრება? (Ras shvreba?)-What is he/she/it doing? The answers on this simple question can be posed by simply conjugating the verb in its present tense.

Verbs	Singular	Example Singular	Plural	Example Plural
Subject system I Group	I. ვ ---- II. ---- III. ----ს	I. ვმუშობ II. მუშობ III. მუშობს	I. ვ ---- თ II. ---- თ III. ----ნ,ენ	I. ვმუშობთ II. მუშობთ III. მუშობენ
Object system II Group(7)	I. მ ---- II. გ ---- III. ჰ,ს,ი----	I. მყავს II. გყავს III. ჰყავს	I. გვ ---- II. გ----თ III. ჰსი----თ	I. გვყავს II. გყავთ III. ჰყავთ
Object system II Group(8)	I. მი ---- II. გი ---- III. უ ----	I. მინდა II. გინდა III. უნდა	I. გვი ---- II. გი----თ III. უ----თ	I. გვინდა II. გინდათ III. უნდათ
Object system III Group(9)	I. ვ ---- ები II. ---- ები III. ---- ება	I. ვთბები II. თბები III. თბება	I. ვ ---- ებით II. ---- ებით III. ---- ებიან	I. ვთბებით II. თბებით III. თბებიან
Object system III Group(10)	I. ვ ---- დები II. ---- დები III. ---- დება	I. ვბრაზდები II. ბრაზდები III. ბრაზდება	I. ვ ---- დებით II. ---- დებით III. ---- დებიან	I. ვბრაზდებით II. ბრაზდებით III. ბრაზდებიან
Subject system III Group (11)	I. ვი ---- ები II. ი ---- ები III. ი ---- ება	I. ვილღები II. ილღები III. ილღება	I. ვი ---- ებით II. ი ---- ებით III. ი ---- ებიან	I. ვილღებით II. ილღებით III. ილღებიან

Figure 5- Present tense [1]

In This Figure 4 is information about Present Tense and what is need to get conjugated verb. Input is Second singular person.



To build first singular present need to conjugate verb from second singular (2s) to first singular (1s) and add preradical "v". **To build Third singular present** need to conjugate verb from from 2s to 3s and add ending "s".

To build First plural present need to conjugate verb from from 1s to 1p and add ending "t".

To build Second plural present need to conjugate verb from Second Singular Present to Second singular present and add ending "t".

To build Third plural present need to conjugate verb from 3s to 3p and add ending "an" (sg5) or "en" (sg1, sg2, sg3, sg4, sg6).

2.1 Present Tense, Group1.

We discuss Present Tense, Group1 and its subgroups from Fig <5>.

To build first singular present need to conjugate verb from second singular (2s) to first singular (1s) and add preradical "v".

And To build Third singular present need to conjugate verb from from 2s to 3s and add ending "s".

From those rules we chose the following operational rules:

Input is second singular form and

- assume 2s is given
- from 2s to 1s : add preradical "v"
- from 2s to 3s : add ending "s"
- from 1s to 1p : add ending "t"
- from 2s to 2p : add ending "t"
- from 3s to 3p : add ending "an" (sg5) or "en" (sg1,sg2,sg3,sg4,sg6)

In Georgian the verb in the present tense has the only (suffix) ending -s in a singular for the third person and first person takes the preradical-v.

Example: მე ვმუშაობ (vmushaob) - I work

შენ მუშაობ (mushaob) - you work

ის მუშაობს (mushaobs) - he/she works

In Plural, the verb takes the (suffix) ending -t at the end of the present tense in first and second persons, plural and in the third person, plural takes the ending- en or an, it depends on subgroups, all subgroups (sg1, sg2, sg3, sg4, sg6) ending is en, except subgroup 5 which ending is an. Also first person takes the preradical-v.

Example: ჩვენ ვმუშაობთ (vmushaobt) - we work

ჩვენ ვტყუით (vTQuit) - we cheat

თქვენ მუშაობთ (mushaobt) - you work

თქვენ ტყუით (TQuit) - you cheat

ისინი მუშაობენ (mushaoben) - they work

ისინი ტყუიან (TQuian) - they cheat

2.2 Present Tense, Group2

We discuss Present Tense, Group2 and its subgroups (sg 7 and sg 8).

Input is second singular form(2s) and we have following rules:

We have chosen the following operational rules for subgroup7.

- assume 2s is given
- from 2s to 1s : change preradical "g" to "m"
- from 2s to 3s : change preradical "g" to "h"
- from 1s to 1p : change preradical "gv"
- from 2s to 2p : change preradical "gQ" add ending t
- from 3s to 3p : change preradical "hQ" add ending t

To conjugate verb from Present tense singular from Second to First must change preradical "g" to "m". From Second to Third must change preradical "g" to "h".

Example: მე დყავს (mQavs) - I have (someone)
 შენ დყავს (gQavs) - you have (someone)
 ის დყავს (hQavs) - he/she has (someone)

In Georgian to conjugate verb in the present tense plural from first Singular to First Plural must change preradical "m" to "gv". From Second Singular to Second plural must change ending "t". And from Third Singular to Third Plural must change ending "t".

Example: ჩვენ დყავს (gvQavs) - we have (something)
 თვენ დყავთ (gQavt) - you have (something)
 ისთ დყავთ (hQavt) - they have (something)

In this subgroup we have extra cases because some verbs have different structure and need to write new rules, for example verb "gakvs" which Georgian Infinitive is "kona" from Second Singular to Third Singular don't need to change preradical.

Example1: მე მაქვს (makvs) - I have
 შენ გაქვს (gakvs) - you have
 მას აქვს (akvs) - he/she have

Verb mogTSons that have preverb “mo” and its Georgian infinitive is moTSoneba from Second Singular to Third Singular need to change preradical “g” to “s”.

Example2: მე მომწონს (momTSons) - I like
 შენ მოგწონს (mogTSons) - you like
 მას მოსწონს (mosTSons) - he/she like

As for subgroup8, we have following rules, Input is second singular.

- assume 2s is given
- from 2s to 1s : change preradical "g" to “m”
- from 2s to 3s : change preradical "g" to “h”
- from 1s to 1p : change preradical "gv"
- from 2s to 2p : change preradical "gQ" add ending t
- from 3s to 3p : change preradical "hQ" add ending t

To conjugate verb from Second Singular to First Singular must change preradical “gi” to “mi”. From Second Singular to Third Singular must change periodical “gi” to “u”.

Example: მე მინდა (minda) - I want
 შენ გინდა (ginda) - you want
 მას უნდა (unda) - he/she want

To conjugate verb from First Singular to First Plural must change preradical “mi” to “gvi”. From Second Singular to Second Plural change ending “-” to “t”. And From Third Singular to Third Plural must change ending “-” to “t”.

Example: ჩვენ გვინდა (gvinda) - we want
 თქვენ გინდათ (gindat) - you want
 მათ უნდათ (undat) - they want

2.3 Present Tense, Group 3

In this section we discuss Present Tense, Group3 and its subgroups sg9, sg10 and sg11.

For the subgroup9 we have following rules. Input is second singular.

- assume 2s is given
- from 2s to 1s : add preradical "-" to "v"
- from 2s to 3s : change ending "-" to "a"
- from 1s to 1p : change ending "-" to "it"
- from 2s to 2p : change ending "-" to "it"
- from 3s to 3p : change ending "-" to "ian"

To conjugate verb from Second Singular to First Singular must add preradical "-" to "v". From Second Singular to Third Singular must change ending "-" to "a".

Example: მე ვთბები (vtbebi) - I warm
 შენ თბები (tbebi) - you warm
 ის თბება (tbeba) - he/she warms

To conjugate verb from first Singular to First Plural must change ending "-" to "it". From Second Singular to Second Plural must change ending "-" to "it". ". From Third Singular to Third Plural must change ending "-" to "ian".

Example: ჩვენ ვთბები (vtbebit) - we warm
 თქვენ თბები (tbebit) - you warm
 ისინი თბებიან (tbebian) - they warm

For the subgroup10 we have following rules and input is second form singular.

- assume 2s is given
- from 2s to 1s : add preradical "-" to "v"
- from 2s to 3s : change ending "-" to "a"
- from 1s to 1p : change ending "-" to "it"
- from 2s to 2p : change ending "-" to "it"
- from 3s to 3p : change ending "-" to "ian"

To conjugate verb from Second Singular to First Singular must add preradical “-” to “v”. From Second Singular to Third Singular must change ending “-“ to “a”.

Example: მე ვბრაზდები (vbrazdebi) - I angry
 შენ ბრაზდები (brazdebi) - you angry
 ის ბრაზდება (brazdeba) - he/she angry

To conjugate verb from first Singular to First Plural must change ending ”-“ to “it”. From Second Singular to Second Plural must change ending ”-“ to “it”. From Third Singular to Third Plural must change ending “-“ to “ian”.

Example: ჩვენ ვბრაზდებით (vbrazdebit) - we angry
 თქვენ ბრაზდებით (brazdebit) - you angry

ისინი ბრაზდებიან (brazdebian) - they angry

For the subgroup11 we have same situation as subgroup9 and subgroup10.

Input is Second Singular.

- assume 2s is given
- from 2s to 1s : add preradical "-" to "v"
- from 2s to 3s : change ending "-" to "a"
- from 1s to 1p : change ending "-" to "it"
- from 2s to 2p : change ending "-" to "it"
- from 3s to 3p : change ending "-" to "ian"

To conjugate verb from Second Singular to First Singular must add preradical "-" to "v". From Second Singular to Third Singular must change ending "-" to "a".

Example: მე ვიღლები (vighlebi) - I tired
შენ იღლები (ighlebi) - you tired
ის იღლება (ighleba) - he/she tired

To conjugate verb from first Singular to First Plural must change ending "-" to "it". From Second Singular to Second Plural must change ending "-" to "it". From Third Singular to Third Plural must change ending "-" to "ian".

Example: ჩვენ ვიღლებით (vighlebit) - we are tired
თქვენ იღლებით (ighlebit) - you tired
ისინი იღლებიან (ighlebian) - they tired

In subgroup 11 we have verb “djebi”, which subgroup according the book [1] is subgroup14, but it works perfectly and behave like group3 and subgroup11.

2.4 Present Tense, Group 4

Group 4 consists of irregular verbs and these verbs are in subgroup14 and subgroup15. As for subgroup15, in this book (book of Nana Shavtvaladze, "Georgian Language for English Speakers") is not this subgroup. We added subgroup15 and write other rules, because in this subgroup are verbs, which require different rules to conjugate.

For the subgroup14 we have following rules.

- assume 2s is given
- from 2s to 1s : add preradical "-" to "v"
- from 2s to 3s : change ending "-" to "s"
- from 1s to 1p : change ending "-" to "it"
- from 2s to 2p : change ending "-" to "it"
- from 3s to 3p : change ending "-" to "ian"

To conjugate verb from Second Singular to First Singular must add preradical "-" to "v". From Second Singular to Third Singular must change ending "-" to "s".

Example: მე ვარკვევ (varkvev) - I clear up
შენ არკვევ (arkvev) - you clear up
ის არკვევს (arkvevs) - he/she clear up

To conjugate verb from first Singular to First Plural must change ending "-" to "t". From Second Singular to Second Plural must change ending "-" to "t". From Third Singular to Third Plural must change ending "s" to "en".

Example: ჩვენ ვარკვევთ (varkvevt) - we clear up
თქვენ არკვევთ (arkvevt) - you clear up
ისინი არკვევენ (arkveven) - they clear up

Also, in this subgroup we have extra cases because some verbs have different structure and require other rules, for example verb "gamogdis" and its Georgian infinitive "gamosvla", preverb is "gamo" in

this case need change preradical “g” to “m” from Second Singular to First Singular. And from Second Singular to Third Singular need change preradical “g” to “s”.

Example: მე გამოძდის (gamomdis) - we do
შენ გამოგდის (gamogdis) - you do
მას გამოსდის (gamosdis) - they do

And in Plural to conjugate verb from First Singular to First Plural need change preradical ”m” to “gv” and from third singular to third plural need change ending “-“ to “t”

Example: ჩვენ გამოგვდის (gamogvdis) - we do
თქვენ გამოგდით (gamogdit) - you do
მათ გამოსდით (gamosdit) - they do

As for our new subgroup15, input is also second singular and we have following rules to conjugate verb. Therefore each of verb has own subgroup that is described in book [1], but these verbs require other rules, we pasted these verb in subgoup15.

Input form is Second Singular and to conjugate verb from Second singular to first singular need to add preradical v and change ending “xar” to “var”.

Example: მე მივდივარ (mivdivar) - I go
შენ მიდიხარ (midixar) - you go
ის მიდის (midis) - he/she goes

As for plural To conjugate verb from first Singular to First Plural must add ending ”-“ to “t”. From Second Singular to Second Plural must add ending ”-“ to “khart”. From Third Singular to Third Plural must change ending “s“ to “an”.

Example: ჩვენ მივდივართ (mi^vdivart) - we go
შენ მიდიხართ (midikhart) - you go
ის მიდიან (midian) - they go

Also we have extra cases, because these verbs are irregulars and require other rules. Some verbs requires to change root in third plural, for example, verb: zis and Georgian infinite is djdoma(seat down). To conjugate verb from third singular to third plural need change root “zi” to “skhed” and change ending “s” to “an”.

მე ვზივარ

შენ ზიხარ

ის ზის

ჩვენ ვზივართ (vzivart)

შენ ზიხართ (zixart)

ისინი სხედან (skhedan)

2.5 Exceptions of Present tense.

Group	subgroup	number of tested verbs	number of exceptions
			present
Group1	sg1	6	
	sg2	48	
	sg3	3	
	sg4	20	
	sg5	3	
	sg6	2	
Group2	sg7	5	2
	sg8	4	
Group3	sg9	7	
	sg10	3	
	sg11	3	
Group4	sg12		
	sg13		
	sg14	9	1
	sg15	5	3

Figure 6- exceptions in Present tense

As for exceptions in present tense, we have 2 exceptions in subgroup7 from 5 verbs. One exception in subgroup14 and 3 exceptions in subgroup15.

3 Future Tense

As stated in the future is used to express an event that will take place in the future ("S/he *will verb*").

Most first conjugation verbs are characterized in the future tense by the presence of a **preverb**.

Preverbs can add either directionality or an arbitrary meaning to the verb.

Verbs	Singular	Examples Singular	Plural	Examples Plural
Subject System I Group	I. ვი ---- ებ II. ----ებ III. ---ებს	ვილაპარაკებ ილაპარაკებ ილაპარაკებს	I. ვი ---- ებთ II. ----ებთ III. ---ებენ	ვილაპარაკებთ ილაპარაკებთ ილაპარაკებენ
Subject System I Group (2,4,5,6)	I. prev. ვ --- II. prev. ---- III. prev. ---ს	გავაკეთებ გაკეთებ გაკეთებს	I. prev. ვ ---თ II. prev. ----თ III. prev. ---ენ	გავაკეთებთ გაკეთებთ გაკეთებენ
Object System II Group(7)	I. მე ---- ება II. გე ---- ება III. ე --- ება	მეყოლება გეყოლება ეყოლება	I. გვე ---- ება II. გე ---- ებათ III. ე --- ებათ	გვეყოლება გეყოლებათ ეყოლებათ
Object System II Group(8)	I. მე ---- ება II. გე ---- ება III. ე --- ება	მენდომება გენდომება ენდომება	I. გვე ---- ება II. გე ---- ებათ III. ე --- ებათ	გვენდომება გენდომებათ ენდომებათ
Subject System III Group (9)	I. prev. ვ --- II. prev. ---- III. prev. ---ა	გავთბები გათბები გათბება	I. prev. ვ ---თ II. prev. ----თ III. prev. ---ან	გავთბებით გათბებით გათბებიან
Subject System III Group (10)	I. prev. ვ --- II. prev. ---- III. prev. ---ა	გავბრაზდები გაბრაზდები გაბრაზდება	I. prev. ვ ---თ II. prev. ----თ III. prev. ---ან	გავბრაზდებით გაბრაზდებით გაბრაზდებიან
Subject System III Group (11)	I. prev. ვი ---ი II. prev. ი ----ი	დავიღლები დაიღლები	I. prev. ვი ---ით II. prev. ი ----ით	დავიღლებით დაიღლებით

	III. prev. ო---ა	დაილლება	III. prev. ო---იან	დაილლებიან
--	-------------------------	-----------------	---------------------------	-------------------

Figure 7- future tense [1]

In the figure6 is information about Future tense and the process how to change verb in conjugation time. As from the book [1], we know that verbs is divided into four groups and 14 subgroups (sg). There are no rules or examples for subgroups 12, 13 and 14.

For example:

Verb in Present tense, Group1:

- მე **ვაკეთებ** - I do
- შენ **აკეთებ** - you do
- ის **აკეთებს** - he/she does

Same verb is in Future Tense

- მე **გავაკეთებ** - I'll do (გა- is preverb, ვ- preradical)
- შენ **გაკეთებ** - you'll do (გა- is preverb)
- ის **გაკეთებს** - he/she will does (გა- is preverb, ს- ending).

To get verb in this form need to conjugated verb from singular present to singular future, also same is in a plural. For this case need to add preverb.

3.1 Future tense. (Group1 & Group3)

According to book [1] to conjugate a verb in the future, we need the verb in the present tense, to which should be added a preverb. As we know from this book, conjugation of verbs is divided into four types and 14 parts and we have also a new subgroup 15 that contains irregular verbs, like subgroup 14.

To build First, Second and Third Singular and also First, Second and Third Plural Future forms we need to add a preverb to present forms. For the verbs of Group 1 and Group 3 (sg1, sg2, sg3, sg4, sg5, sg6, sg9, sg10, sg11), that is the only needed transformation. Preverbs are specific prefixes that are added only to verbs.

There exist many preverbs in Georgian:

წა (Tsa), გან(Gan), გა(Ga), მი(Mi), მო(Mo), მიმო(Mimo), და(Da), ა(A), გადა(Gada),
გადმო(Gadmo), შე(she), შემო(Shemo), ჩა(Cha), ჩამო(Chamo), ამო(Amo).

Here is an information and rules how to conjugate verbs to build first singular and etc.

To build first singular future need to conjugate verb from First Singular Present to First Singular Future.

To build Second singular future need to conjugate verb from Second Singular Present to Second Singular Future.

To build Third singular future need to conjugate verb from Third Singular Present to Third Singular Future

To build First plural future need to conjugate verb from First Plural Present to First Plural Future.

To build Second plural future need to conjugate verb from Second Plural Present to Second Plural Future.

To build Third plural future need to conjugate verb from Third Plural Present to Third Plural Future.

For example: Group3, subgroup9, Georgian infinitive: ganvitareba

Verb in Present:

მე ვვითარდები(vvitardebi) - I develop

შენ ვითარდები(vitardebi) - you develop

ის ვითარდება(vitardeba) - he/she develop

Verb in Future:

მე განვვითარდები(ganvvitardebi) - I will develop

შენ განვითარდები(ganvitardebi) - you will develop

ის განვითარდება(ganvitardeba) - he/she will develop

For this case vitardebi is a verb of present tense and verb ganvvitardebi is verb of future tense, where გან(gan) is Preverb, ვ(v) is preradical, ვითარ(vitar) is root, დ(d) is postradical, ებ(eb) is PSFS and ი(i) is ending.

And verb Future in all persons add only preverb.

3.1.1 Exceptions of Future tense:

Group	subgroup	number of tested verbs	number of exceptions		
			present	imperfect	future
Group1	sg1	6			4
	sg2	48			2
	sg3	3			
	sg4	20			
	sg5	3			1
	sg6	2			

Figure 8-Exceptions in Future Tense

In Test data, there are verbs (total- 118 verbs) and they have each group and subgroup we have exceptions that need other rule to conjugation, for example in Group1, sg1 Georgian infinitive - kiraoba. It's a verb that has not preverb in Future and only is need to change PSFS, Postradical, Preradical and in subgroup5, Georgian infinitive is TQuili, where is need to change PSFS, Preradical.

In subgroup 9, 10 and 11 we have not exceptions.

3.2 Future Tense (Group2& Group4)

As for other groups and subgroups almost all verbs need own rule to conjugated as in singular as plural.

In Group2, Subgroup7 all verbs are exceptions and In Subgroup 8 almost verbs are exceptions.

For example: Georgian Infinitive **kona**, subgroup7, Person First Singular.

მე მაქვს- makvs (I have)- present

მე მექნება- mekneba (I will have)- in future.

To conjugate verb in Future is need change root (akv -> kn), change PFSF(“ - -> eb), change preradical(m -> me) and change ending s ->a .

In Group4- subgroup14 and subgroup 15 all verbs are irregulars they need also own rules to conjugate.

3.1.2 Exceptions of Future tense:

In subgroup7, Subgroup8 and subgroup15 all verbs in Future are exceptions. In subgroup14 from 9 verbs we have only 2 exceptions.

Group	subgroup	number of tested verbs	number of exceptions		
			present	imperfect	future
Group2	sg7	5	2	3	5
	sg8	4		2	4
	sg12				
	sg13				
Group4	sg14	9	1		2
	sg15	5	3	3	5

Figure 9- Exceptions in Future Tense group2&group4

5. Prolog

Expected interface: To conjugation verb we need to input was in second singular and user gives second singular and the software proposes conjugated forms, the user should be able to validate.

For this we use the code of the prolog.

Short for Programming Logic, Prolog is a high-level programming language based on formal logic. Unlike traditional programming languages that are based on performing sequences of commands, Prolog is based on defining and then solving logical formulas. Prolog is sometimes called a declarative language or a rule-based language because its programs consist of a list of facts and rules. Prolog is used widely for artificial intelligence applications, particularly expert systems.

For example: verb in second singular in prolog looks like this:

```
verb(ConcreteForm, GeorgianInfinitive, EnglishInfinitiveSet, FrenchInfinitiveSet, GeorgianForm,
Group, SubGroup, Tense, Person, Number, Preverb, Preradical, Root, PostRadical, PFSF, Ending,
[PotentialPreverbList, [FuturePreradical, PresentPerfectPreradical | Others]]).
```

Verb (kiraob, kiraoba, [rent], [louer], 'ქირაობ', g1, sg1, present, second, singular, -, -, kira, -, ob, -, [[-],[i, u]]). Where is an information about root, tense, person, preradical, pfsf and etc.

The appropriate rule to conjugate verb will look like this: where input is Second Singular and we will get the verb in First Singular and all verbs, which are in sg1, sg2, sg3, sg4, ag5, ag6, ag9, sg 10, sg11 and sg14 will add preradical v.

შენ - აუქმებ -> მე- **ვ**აუქმებ

You – aukmeb (abolish) -> I – **v**aukmeb (abolish).

```
build_first_sing(GeorgianInfinitive, SubGroup, SecondSing, FirstSing) :-
```

```
    change_person(second, first, SecondSing, Form),
```

```
    build_first_sing_do(GeorgianInfinitive, SubGroup, Form, FirstSing).
```

```
build_first_sing_do(_GeorgianInfinitive, SubGroup, SecondSing, FirstSing) :-
```

```
    member(SubGroup, [sg1, sg2, sg3, sg4, sg5, sg6, sg9, sg10, sg11, sg14]),
```

`add_preradical(_Preradical, v, SecondSing, FirstSing).`

6. Conclusion

Georgian verb database application is very useful and simply to use for English and French learners, who want to learn Georgian language, verbs. As noticed, With this application users have possibility to easily see the verb information, such as Tense, Preverb, English infinitive, Post radical, Georgian form, French Infinitive, Georgian Infinitive, Root, Pre radical, ending. Also they can possibility to see how verb can change in conjugation time. It also allows people to add information in a very flexible and easy way.

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