Horizon Europe Programme - Standard Application Form

Csüllög Benedek
Fülöp Martin
Laczkó Zsófia
Korpa Péter Zsolt

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Horizon Europe Programme

Standard Application Form (HE RIA, IA)

Application form (Part A)

Project proposal - Technical description (Part B)

Version 1.0
10 November 2024

Overview

- Project overview
- Project context
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- Security
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Project overview

- Acronym: PWSAT
- Proposal title: The proper way of solving SAT
- Duration in months: 6
- Fixed keywords: SAT, Logic, Solver, MiniSAT, ManySAT, Parallel
- Main goal: Implement the new efficient algorithm for solving SAT
- Testing the algorithm must be included

Declarations

1) We declare to have the explicit consent of all applicants on their participation and on the content of this proposal.	☑
2) We confirm that the information contained in this proposal is correct and complete and that none of the project activities have started before the proposal was submitted (unless explicitly authorised in the call conditions).	☑
3) We declare: – to be fully compliant with the eligibility criteria set out in the call – not to be subject to any exclusion grounds under the EU Financial Regulation 2018/1046 – to have the financial and operational capacity to carry out the proposed project.	☑
4) We acknowledge that all communication will be made through the Funding & Tenders Portal electronic exchange system and that access and use of this system is subject to the Funding & Tenders Portal Terms & Conditions.	☑
5) We have read, understood and accepted the Funding & Tenders Portal Terms & Conditions and Privacy Statement that set out the conditions of use of the Portal and the scope, purposes, retention periods, etc. for the processing of personal data of all data subjects whose data we communicate for the purpose of the application, evaluation, award and subsequent management of our grant, prizes and contracts (including financial transactions and audits).	☑
6) We declare that the proposal complies with ethical principles (including the highest standards of research integrity as set out in the ALLEA European Code of Conduct for Research Integrity, as well as applicable international and national law, including the Charter of Fundamental Rights of the European Union and the European Convention on Human Rights and its Supplementary Protocols. Appropriate procedures, policies and structures are in place to foster responsible research practices, to prevent questionable research practices and research misconduct, and to handle allegations of breaches of the principles and standards in the Code of Conduct.	☑
7) We declare that the proposal has an exclusive focus on civil applications (activities intended to be used in military application or aiming to serve military purposes cannot be funded). If the project involves dual-use items in the sense of Regulation 2021/821, or other items for which authorisation is required, we confirm that we will comply with the applicable regulatory framework (e.g. obtain export/import licences before these items are used).	☑
8) We confirm that the activities proposed do not – aim at human cloning for reproductive purposes; – intend to modify the genetic heritage of human beings which could make such changes heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed), or – intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer. – lead to the destruction of human embryos (for example, for obtaining stem cells) These activities are excluded from funding.	☑

Project Context

- Our article of the new SAT solver gained huge success
- Industry partners reached out

Ethics security

1. HUMAN EMBRYONIC STEM CELLS AND HUMAN EMBRYOS			Page
Does this activity involve Human Embryonic Stem Cells (hESCs)?		○ Yes ◉ No	
If YES:	Will they be directly derived from embryos within this project?	○ Yes ○ No	
	Are they previously established cells lines?	○ Yes ○ No	
	Are the cell lines registered in the European registry for human embryonic stem cell lines?	○ Yes ○ No	
Does this activity involve the use of human embryos?		○ Yes ◉ No	
If YES:	Will the activity lead to their destruction?	○ Yes ○ No	
2. HUMANS			Page
Does this activity involve human participants?		○ Yes ◉ No	
If YES:	Are they volunteers for nonmedical studies (e.g. social or human sciences research)?	○ Yes ○ No	
	Are they healthy volunteers for medical studies?	○ Yes ○ No	
	Are they patients for medical studies?	○ Yes ○ No	
	Are they potentially vulnerable individuals or groups?	○ Yes ○ No	
	Are they children/minors?	○ Yes ○ No	
	Are they other persons unable to give informed consent?	○ Yes ○ No	
Does this activity involve interventions (physical also including imaging technology, behavioural treatments, etc.) on the study participants?		○ Yes ◉ No	
If YES:	Does it involve invasive techniques?	○ Yes ○ No	
	Does it involve collection of biological samples?	○ Yes ○ No	

This proposal version was submitted by Angry Goat on 20/11/2024 17:52 Brussels Local Time. Issued by the Funding and

Ethics security

Does this activity involve conducting a clinical study as defined by the Clinical Trial Regulation (EU 536/2014)? (using pharmaceuticals, biologicals, radiopharmaceuticals, or advanced therapy medicinal products)		○ Yes ◉ No	
If **YES**:	Is it a clinical trial?	○ Yes ○ No	
	Is it a low-intervention clinical trial?	○ Yes ○ No	
3. HUMAN CELLS / TISSUES (not covered by section 1)			Page
Does this activity involve the use of human cells or tissues?		○ Yes ◉ No	
If **YES**:	Are they human embryonic or foetal cells or tissues?	○ Yes ○ No	
	Are they available commercially?	○ Yes ○ No	
	Are they obtained within this project?	○ Yes ○ No	
	Are they obtained from another project, laboratory or institution?	○ Yes ○ No	
	Are they obtained from biobank?	○ Yes ○ No	
4. PERSONAL DATA			Page
Does this activity involve processing of personal data?		○ Yes ◉ No	
If **YES**:	Does it involve the processing of special categories of personal data (e.g.: sexual lifestyle, ethnicity, genetic, biometric and health data, political opinion, religious or philosophical beliefs)?	○ Yes ○ No	
	If **YES**: Does it involve processing of genetic, biometric or health data?	○ Yes ○ No	
	Does it involve profiling, systematic monitoring of individuals, or processing of large scale of special categories of data or intrusive methods of data processing (such as, surveillance, geolocation tracking etc.)?	○ Yes ○ No	
Does this activity involve further processing of previously collected personal data (including use of preexisting data sets or sources, merging existing data sets)?		○ Yes ◉ No	
Is it planned to export personal data from the EU to non-EU countries?		○ Yes ◉ No	
If **YES**:	Specify the type of personal data and countries involved:		

Ethics security

Does this activity involve the processing of personal data related to criminal convictions or offences?		○ Yes ◉ No	
5. ANIMALS			Page
Does this activity involve animals?		○ Yes ◉ No	
If YES:	Are they vertebrates?	○ Yes ○ No	
	Are they non-human primates (NHP)?	○ Yes ○ No	
	Are they genetically modified?	○ Yes ○ No	
	Are they cloned farm animals?	○ Yes ○ No	
	Are they endangered species?	○ Yes ○ No	
6. NON-EU COUNTRIES			Page
Will some of the activities be carried out in non-EU countries?		○ Yes ◉ No	
If YES:	Specify the countries:		
In case non-EU countries are involved, do the activities undertaken in these countries raise potential ethics issues?		○ Yes ◉ No	
If YES:	Specify the countries:		
Is it planned to use local resources (e.g. animal and/or human tissue samples, genetic material, live animals, human remains, materials of historical value, endangered fauna or flora samples, etc.)?		○ Yes ◉ No	
Is it planned to import any material (other than data) from non-EU countries into the EU or from a non-EU country to another non-EU country? For data imports, see section 4.		○ Yes ◉ No	
If YES:	Specify material and countries involved:		
Is it planned to export any material (other than data) from the EU to non-EU countries? For data exports, see section 4.		○ Yes ◉ No	
If YES:	Specify material and countries involved:		
Does this activity involves low and/or lower-middle income countries? (if yes, detail the benefit-sharing actions planned in the self-assessment)		○ Yes ◉ No	

Ethics security

Does this activity involve the use of substances or processes that may cause harm to the environment, to animals or plants (during the implementation of the activity or further to the use of the results, as a possible impact)?	○ Yes ◉ No	
Does this activity deal with endangered fauna and/or flora / protected areas?	○ Yes ◉ No	
Does this activity involve the use of substances or processes that may cause harm to humans, including those performing the activity (during the implementation of the activity or further to the use of the results, as a possible impact)?	○ Yes ◉ No	
8. ARTIFICIAL INTELLIGENCE		Page
Does this activity involve the development, deployment and/or use of Artificial Intelligence based systems? (if yes, detail in the self-assessment whether that could raise ethical concerns related to human rights and values and detail how this will be addressed).	○ Yes ◉ No	
9. OTHER ETHICS ISSUES		Page
Are there any other ethics issues that should be taken into consideration?	○ Yes ◉ No	
Please specify: (Maximum number of characters allowed: 1000)		

Security

1. EU classified information (EUCI)[2]			Page
Does this activity involve information and/or materials requiring protection against unauthorised disclosure (EUCI)?		○ Yes ◉ No	
If **YES**:	Is the activity going to use classified information as background[3] information?	○ Yes ○ No	
	Is the activity going to generate EU classified foreground[4] information as results?	○ Yes ○ No	
Does this activity involve participants from non-EU countries which need to have access to EUCI?		○ Yes ◉ No	
If **YES**:	Do the non-EU countries concerned have a security of information agreement with the EU?	○ Yes ○ No	
2. MISUSE			Page
Does this activity have the potential for misuse of results?		○ Yes ◉ No	
If **YES**:	Does the activity provide knowledge, materials and technologies that could be channelled into crime and/or terrorism?	○ Yes ○ No	
	Could the activity result in the development of chemical, biological, radiological or nuclear (CBRN) weapons and the means for their delivery?	○ Yes ○ No	
3. OTHER SECURITY ISSUES			Page
Does this activity involve information and/or materials subject to national security restrictions?		○ Yes ◉ No	
If yes, please specify: *(Maximum number of characters allowed: 1000)*			

Beneficiaries

- We will implement the new SAT solver algorithm and its innovative framework
- Designed for universal accessibility
- The framework will be available for general public and public sector organizations

Levels of risk

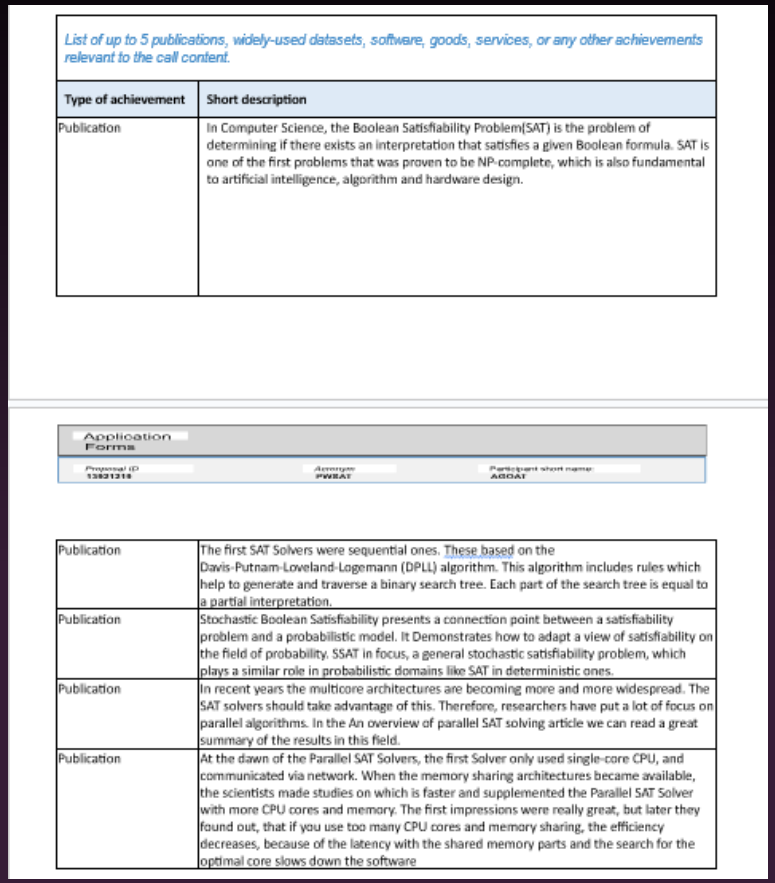
Difficult to handle highly complex problems like SAT.
Level of likelihood to occur: High

- Despite improvements in SAT solver algorithms, the risk remains high due to the nature of NP-complete problems.

Level of severity: High

- The impact is high especially in systems where SAT solvers are critical components. It could result in higher computational costs.

Publications



List of up to 5 publications, widely-used datasets, software, goods, services, or any other achievements relevant to the call content.

Type of achievement	Short description
Publication	In Computer Science, the Boolean Satisfiability Problem(SAT) is the problem of determining if there exists an interpretation that satisfies a given Boolean formula. SAT is one of the first problems that was proven to be NP-complete, which is also fundamental to artificial intelligence, algorithm and hardware design.

Application Forms

Proposal ID 13931316 | Acronym PWEAT | Participant short name: AGOAT

Publication	The first SAT Solvers were sequential ones. These based on the Davis-Putnam-Loveland-Logemann (DPLL) algorithm. This algorithm includes rules which help to generate and traverse a binary search tree. Each part of the search tree is equal to a partial interpretation.
Publication	Stochastic Boolean Satisfiability presents a connection point between a satisfiability problem and a probabilistic model. It Demonstrates how to adapt a view of satisfiability on the field of probability. SSAT in focus, a general stochastic satisfiability problem, which plays a similar role in probabilistic domains like SAT in deterministic ones.
Publication	In recent years the multicore architectures are becoming more and more widespread. The SAT solvers should take advantage of this. Therefore, researchers have put a lot of focus on parallel algorithms. In the An overview of parallel SAT solving article we can read a great summary of the results in this field.
Publication	At the dawn of the Parallel SAT Solvers, the first Solver only used single-core CPU, and communicated via network. When the memory sharing architectures became available, the scientists made studies on which is faster and supplemented the Parallel SAT Solver with more CPU cores and memory. The first impressions were really great, but later they found out, that if you use too many CPU cores and memory sharing, the efficiency decreases, because of the latency with the shared memory parts and the search for the optimal core slows down the software

- DPLL
- VSIDS
- CDCL
- Stochastic search

Previous projects

Our team was not involved in previous SAT projects. But historically they have been successful.

- ManySAT was developed with support from Microsoft research
- Big projects like this have a high success rate

Participants

Project participants

- Eötvös Loránd University (HU)
- Eidgenössische Technische Hochschule Zürich (CH)
- Katholieke Universiteit Leuven (BE)
- Microsoft

ETH

Eidgenössische Technische Hochschule Zürich

- Renowned University in Zürich
- Has a strong base of coder
- ELTE had previous projects with ETH

KU

Katholieke Universiteit Leuven

- Known for their strong program verification department
- Various techniques of program verification (HOL, Dependent type theories)

MS

Microsoft

- They reached out
- Big investor in future technologies
- Strong testing capabilities (Test cases, Hardware)

Project implementation

- Produce a well tested implementation of our algorithm
- With the help of industry partners
- The coordinator is us
- Follow things learned from previous projects
- Work through the work packages as outlined in the Gant chart

Costs

			Estimated expenditure								Estimated income						
											Requestied EU contribution			Revenuse	Other sources of financing		Total estimated income
			Estimated eligible costs								EU contribution to eligible costs			Income generated by action	Financial contributions	Own resources	
No	Participant name	Country	Personnel costs (euro)	Subcontracting costs (euro)	Purchase costs			Other Costs	Indirect costs	Total eligible costs	Funding rate	Maximum EU contribution to eligible costs	Requested EU contribution to eligible costs				
					Travel and subsistance	Equipment	Other										
1	Eötvös Loránd University	HU	100 000	3 200	2 260				26500	132500	10000	1325000	525000			10000	535000
2	Eidgenössische Technische Hochschule Zürich	CH	70 000	1 600	1 000				10000	82600	10000	826000	413000			40000	453000
3	Katholieke Universiteit Leuven	BE	50 000	1 600	1 000	20000			10000	82600	10000	826000	413000			40000	453000
4	Microsoft	USA	30000	1 600	1 000	10000	10000		10000	62600	10000	626000	313000	40000		20000	373000
Total			250000	8000	5260	30000	10000		56500	360300	40000	3603000	1664000	40000		110000	1814000

Figure: Cost table detailing various costs associated with the project

Costs breakdown

Table 3.1i: 'Other costs categories' items (e.g. internally invoiced goods and services)

Please complete the table below for each participant that would like to declare costs under other costs categories (e.g. internally invoiced goods and services), irrespective of the percentage of personnel costs.

1 Péter		
	Cost (€)	**Justification**
Internally invoiced goods and services	1000	Renting the workplace.
Internally invoiced goods and services	100	Overhead of the workplace.
...		

Table 3.1j: 'In-kind contributions' provided by third parties

Please complete the table below for each participant that will make use of in-kind contributions (non-financial resources made available free of charge by third parties). In kind contributions provided by third parties free of charge are declared by the participants as eligible direct costs in the corresponding cost category (e.g. personnel costs or purchase costs for equipment).

Pa1 Péter			
Third party name	**Category**	**Cost (€)**	**Justification**
Eötvös Loránd University	Seconded personnel **Select between** Seconded personnel Travel and subsistence Equipment Other goods, works and services Internally invoiced goods and services	20	Maintain a workplace.

Roles and Responsibilities

Work package No	Work Package Title	Lead Participant No	Lead Participant Short Name	Person-Months	Start Month	End month
WP1	Project Management	1	ELTE	4	1	6
WP2	Background Research and Information Collection	1	ELTE	4	1	1
WP3	Algorithm Development	1	ELTE	10	2	3
WP4	Validation and Testing	1	ELTE	8	4	5
WP5	Communication and Dissemination	1	ELTE	4	6	6

WP1 - Project Management

Objectives: manage the project, the human and physical resources, and to monitor the progress of the project
Participant: ELTE
Description of work:

- ensure that all phases of the project are completed on time and within the specified deadlines
- communication between participants
- human resources management, which includes the selection of the necessary specialists (e.g. researchers, developers) and the optimal distribution of their workload
- providing the necessary tools and technological infrastructure for the project

WP2 - Background Research and Information Collection

Objectives: explore the results achieved so far in the field of SAT solving and parallel algorithms, plan the research
Participant: ELTE
Description of work:

- explore the history of SAT problem, get to know the fields of application of SAT solvers
- examine the algorithms known so far
- explore parallel algorithms and learn how these split the search across multiple processors
- examine the weaknesses of the existing algorithms
- planning of the research and the algorithm

WP3 - Algorithm Development

Objectives: create our algorithm
Participant: ELTE, ETH
Description of work:

- the algorithm has to be specified
- create the algorithm with transfer the given formula for the correct form to analyse it
- create the splitting strategies
- decide the number of threads
- decide what information will be shared between threads
- collect heuristics
- runtime, hardware usage optimalization

WP4 - Validation and Testing

Objectives: validate the correction of our algorithm and test it while running
Participant: ELTE, KU, Microsoft
Description of work:

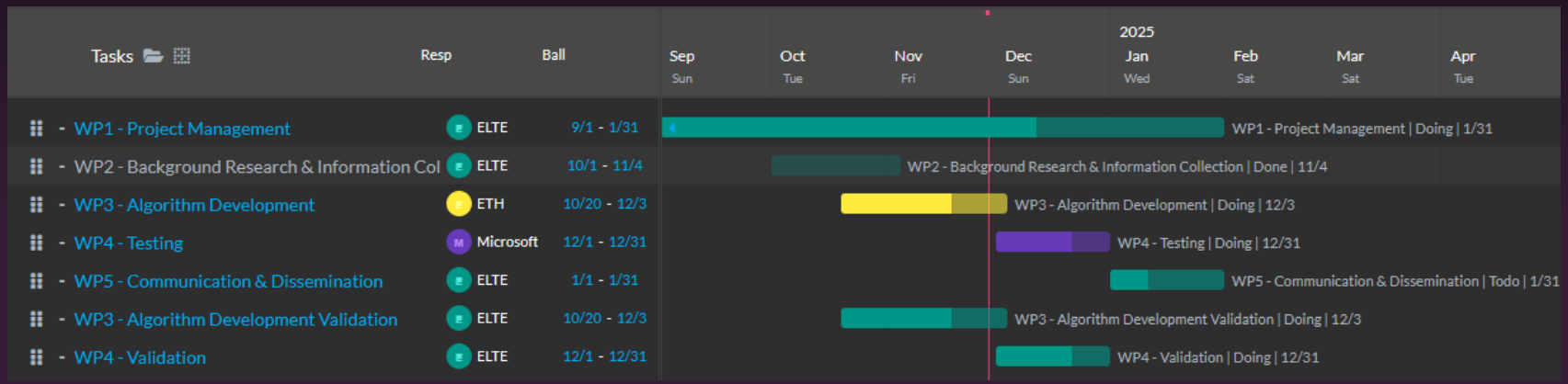
- check whether the algorithm solves the given problem, as well as whether it is error-free and optimality from the perspective of performance
- runtime, computational cost and hardware usage need to be tested
- write the documentation

WP5 - Communication and Dissemination

Objectives: introduce our results to the world
Participant: ELTE
Description of work:

- promote the research with demonstrations and presentations, for example in universities
- create live podcasts for instance academic researchers could ask about the topic
- give presentations in some company campuses
- create an official website where anyone could give our research team feedback (public email address and online form)

Gant chart


Tasks
Resp
Ball
Sep
Sun
Oct
Tue
Nov
Fri
Dec
Sun
2025
Jan
Wed
Feb
Sat
Mar
Sat
Apr
Tue
WP1 - Project Management
ELTE
9/1 - 1/31
WP1 - Project Management | Doing | 1/31
WP2 - Background Research & Information Col
ELTE
10/1 - 11/4
WP2 - Background Research & Information Collection | Done | 11/4
WP3 - Algorithm Development
ETH
10/20 - 12/3
WP3 - Algorithm Development | Doing | 12/3
WP4 - Testing
Microsoft
12/1 - 12/31
WP4 - Testing | Doing | 12/31
WP5 - Communication & Dissemination
ELTE
1/1 - 1/31
WP5 - Communication & Dissemination | Todo | 1/31
WP3 - Algorithm Development Validation
ELTE
10/20 - 12/3
WP3 - Algorithm Development Validation | Doing | 12/3
WP4 - Validation
ELTE
12/1 - 12/31
WP4 - Validation | Doing | 12/31

Conclusion

- First level beneficiaries
- Second level beneficiaries
- Future possibilities

Thank you for your attention!