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DEPARTAMENTO DE COMPUTACIÓN,  
FACULTAD DE CIENCIAS EXACTAS Y NATURALES,  
UNIVERSIDAD DE BUENOS AIRES



**DEPARTAMENTO  
DE COMPUTACION**

Facultad de Ciencias Exactas y Naturales - UBA



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# Clasificación automática de posts en foros de salud mental

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Los foros de apoyo son espacios donde las personas pueden compartir sus experiencias y pensamientos anónimamente en una comunidad con intereses comunes. En particular, los foros orientados a temas de salud mental necesitan la supervisión de moderadores para brindar apoyo en casos delicados, como mensajes que expresan ideas suicidas. A medida que aumenta el tamaño del foro, la supervisión del moderador deja de ser factible sin la ayuda de sistemas automatizados de priorización.

En el presente artículo presentamos un sistema de aprendizaje automático supervisado para el triaje (clasificación según severidad) de mensajes de una red social de salud mental. Aplicamos un enfoque orientado en la generación y extracción de nuevos atributos capaces de captar el contenido semántico del post, el contexto en el que se produce, el estado mental del autor y su red de interacción. El amplio espectro de atributos extraídos incluyen word embeddings, léxicos psicolingüísticos, expresiones regulares y análisis de coherencia entre otros.

El desempeño obtenido con nuestro modelo en la clasificación de posts supera el estado del arte en esta tarea. A su vez, realizamos un análisis de importancia de atributos, el cual evidencia la relevancia de los léxicos psicolingüísticos y de los atributos que caracterizan las interacciones entre usuarios.

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## Understanding word predictability using Natural Language Processing algorithms

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During reading our brain predicts upcoming words. Predictability (probability of guessing the next word) is currently estimated by performing cloze experiments, where participants read incomplete statements and have to complete them with one word. During the task, the only information subject can use is the preceding context. To estimate the predictability of one word, it is necessary to ask several participants, and then calculate the proportion of correct answers. Cloze-task is then an expensive experiment, and results are only valid for those words in the analyzed texts. During the last years, different approaches have been taken to automatically estimate this human predictability. Here we analyzed different ways of predicting words, using Natural Language Processing algorithms (LSA, word2vec, n-grams), and explore different aspects of the human predictability (semantic, syntactic, mnemonic). We evaluated the incorporation of these computational measures, both by themselves or combined on Linear Mixed Models with eye movements as dependent variables. Results show that these computational estimations of the word predictability have very good performance and can be used to replace the human predictability in the used models. Further, this is a step forward in understanding and separating the contribution of the different cues we use to predict words.

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## Characterizations of special classes of contact $B_0$ -VPG graphs

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A VPG representation of a graph  $G$ , is a collection of paths  $P$  of the two-dimensional grid  $G$  where the paths represent the vertices of  $G$  in such a way that two vertices of  $G$  are adjacent in  $G$  if and only if the corresponding paths share at least one vertex of the grid. A graph which has a VPG representation is called a VPG graph (VPG stands for Vertex-intersection of Paths on a Grid). A  $B_0$ -VPG representation of  $G$  is a VPG representation in which each path in the representation is horizontal or vertical. Recognizing  $B_0$ -VPG graphs is an NP-complete problem [1]. Although there exists a polynomial time algorithm to recognize chordal  $B_0$ -VPG graphs [2]. A graph  $G$  is a contact  $B_0$ -VPG graph if it has a  $B_0$ -VPG representation in which no two paths cross and no two paths share an edge of the grid. The main result of this work is the characterization of contact  $B_0$ -VPG graphs by minimal forbidden induced subgraphs within some graph classes.

[1] A. Asinowski, E. Cohen, M.C. Golumbic, V. Limouzy, M. Lipshteyn, and M. Stern. Vertex intersection graphs of paths on a grid. *Journal of Graph Algorithms and Applications*, 16(2):129–150, 2012.

[2] S. Chaplick, E. Cohen, and J. Stacho. Recognizing some subclasses of vertex intersection graphs of 0-bend paths in a grid. *Lecture Notes in Computer Science*, 6986:319–330, 2011.

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# Automatic detection of turn-taking events in continuous EEG data from spontaneous dialogue

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In conversation, humans normally exchange turns in swift coordination, with few silences and overlaps, due partly to the existence of turn-taking cues: acoustic, prosodic, lexical or syntactic events that signal an upcoming turn-taking transition. This paper describes a series of machine learning experiments for automatically classifying the type of turn-taking transition based on features extracted from the EEG signal. These were conducted on a corpus of unrestricted dialogues between pairs of subjects, with simultaneous recordings of speech and EEG from both subjects. Our results indicate that the listener's EEG signal contains useful information for predicting whether the current speaker will either yield the conversational turn or continue talking. In other words, we show it is possible to detect the listener's perception of turn-yielding cues present in the speaker's speech. Similarly, from the current speaker's EEG signal we can extract useful information for detecting whether the speaker will yield the turn or continue talking. These results may lead to new tools valuable for the development of brain-computer interfaces.

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# Understanding Partial Verification Attempts

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Software model checking constitutes an undecidable problem and, as such, even an ideal tool will in some cases fail to give a conclusive answer. In practice, undecidability is not the only issue. The vast state spaces can lead to exhaustion of resources or impractically long execution times.

Unfortunately some instances can take hours of computation only to inform that no counterexample was found. Should the user retry with a longer time limit? How much longer? Was the verifier making progress? Maybe try another technique? Previous work has made it possible for tools to generate machine-readable representations of interrupted executions. Our main hypothesis is that the information gathered during verification can be leveraged by users to make informed decision about future verification and testing efforts. So far we have focused on proposing output that responds high-level questions about incomplete verification attempts. For example, we proposed trace-based answers for the following high-level questions:

- Can the incomplete verification attempt provide assurances about concrete executions?
- Are there any behaviors that have not yet been examined by the verification tool? Which?

We implemented our approach for the family of techniques based on Abstract Reachability Trees.

As part of our roadmap, we plan to propose and experiment alternative representations for partial verification results, paying special attention to human-readability and usability.

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## Diagnóstico por Minimización de Comportamiento para Especificaciones no Realizables

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En el comienzo de su ciclo de vida las especificaciones de sistemas reactivos suelen ser no realizables, esto quiere decir que no hay una forma de construir un sistema que satisfaga las propiedades esperadas. La causa de no realizabilidad de la especificación puede reducirse al hecho de que los objetivos de sistema son demasiado fuertes, las suposiciones del ambiente demasiado débiles o, que es lo que sucede con más frecuencia, por una combinación de ambas. Es necesario dar lxs ingenierxs información relevante y resumida que permita evaluar las causas citadas anteriormente para llevar la especificación a una representación realizable. En nuestro trabajo proponemos una técnica que minimiza el comportamiento de una especificación no realizable con garantías GR(1) a la vez que preservamos al menos una parte de la causa de no realizabilidad. Eso permite a lxs ingenierxs enfocarse en el núcleo de comportamiento que impide la satisfacción de nuestras propiedades. Se trata de la primera técnica diseñada para proveer un diagnóstico sobre problemas de síntesis de GR(1) en los que el comportamiento del ambiente se describe a través de un autómata y los objetivos de sistema como un conjunto de fórmula de progreso sobre la lógica LTL. Nuestra técnica tiene también el potencial de complementar trabajo existente donde se asume que la especificación ha sido expresada suando solamente formulas LTL y donde se espera efectuar una reducción sintáctica en lugar de semántica.

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## Fully-reflective VMs for ruling software adaptation.

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A recent survey on paradigms for software adaptation at the language level assessed contemporary reflective systems (RS), aspect-oriented programming (AOP), and context-oriented programming (COP) as three well-established approaches. The survey did not find a clear winner. Our opinion is that this is due to the fact that none of these approaches is flexible enough to handle the diversity of possible adaptation scenarios. The reason is that instead of operating directly on the entity that conceptually requires the adaptation, these approaches often require to handle the adaptations in an indirect fashion. In this paper we advocate that a suitable paradigm for software adaptation at the language level must enable direct modification to every concept at both, the application and the execution environment level. This is enabled by a Fully-Reflective Execution Environment (FREE), a flavor of virtual machine in which every component such as the interpreter and the memory is accessible for inspection and modification, programmatically, and at run time. Consequently, we advocate and illustrate how the notion of a FREE extends RS and subsumes AOP and COP.

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# Directed Controller Synthesis of Discrete Event Systems

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The synthesis of controllers for DES was introduced by Ramadge and Wonham for controlling systems within a given set of constraints. Controller synthesis is related to Automated Planning, where informed search procedures are used to perform a goal-directed exploration. However, the work in planning has been oriented mainly towards non-reactive environments, which are insufficient in the setting in which controller synthesis is applied.

Inspired by planning, we propose the DCS technique that explores the solution space for controllers on-the-fly guided by a domain-independent heuristic. DCS uses an heuristic derived from an abstraction of the environment that exploits the componentized way in which complex environments are described. The on-the-fly exploration is a modification of Best First Search adapted to account for uncontrollable events.

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## Syntactic methods for negation detection in radiology reports in Spanish

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Identification of the certainty of events is an important text mining problem. In particular, biomedical texts report medical conditions or findings that might be factual, hedged or negated. Identification of negation and its scope over a term of interest determines whether a finding is reported and is a challenging task. Not much work has been performed for Spanish in this domain.

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# Prosodic Facilitation and Interference while Judging on the Veracity of Synthesized Statements

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Two primary sources of information are provided in human speech. On the one hand, the verbal channel encodes linguistic content, while on the other hand, the vocal channel transmits paralinguistic information, mainly through prosody. In line with several studies that induce a conflict between these two channels to better understand the role of prosody, we conducted an experiment in which subjects had to listen to a series of statements synthesized with varying prosody and indicate if they believed them to be true or false. We find evidence suggesting that acoustic/prosodic (a/p) features of the synthesized statements affect response times (a well-known proxy for cognitive load). Our results suggest that prosody in synthesized speech may play a role of either facilitation or interference when subjects judge the truthfulness of a statement. Furthermore, we find that this pattern is amplified when the a/p features of the synthesized statements are analyzed relative to the subjects' own a/p features. This suggests that the entrainment of TTS voices has serious implications in the perceived trustworthiness of the system's skills.

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# Specification, Design and Implementation of a Pattern-Based Parallel Programming Framework

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Programming correct parallel software in a cost-effective way is a challenging task. This paper proposes a pattern-based, formally-grounded tool that eases writing parallel code by automatically generating platform-dependent programs from high-level, platform-independent specifications. The tool builds on three pillars: 1) a platform-agnostic parallel-programming pattern, 2) a formal translation of it into a parallel execution model, and 3) a program rewriting engine generating code for a concrete runtime. The contribution of this paper is threefold. First, it discusses a parallel-programming pattern, called PCR, consisting of producers, consumers, and reducers which operate concurrently on data sets. For correctness, the semantics of PCRs is defined in terms of the formalism FXML. PCRs are shown to be composable and to seamlessly subsume other well-known parallel-programming patterns, thus providing a framework for heterogeneous designs. Second, it shows how the PCR pattern can be correctly implemented in terms of a concrete parallel execution model. Third, it proposes a platform-agnostic C++ template library to express PCRs. It presents a prototype source-to-source compilation tool, based on C++ template re-writing, which automatically generates parallel implementations relying on the Intel CnC C++ library. Experimental evaluation gives evidence that correct-by-construction code produced from PCRs can deliver performance metrics which are comparable with hand-written code.

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# Who do you think will speak next? Perception of turn-taking cues in Slovak and Argentine Spanish

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We investigate perceptual cues in human-human dialogue management related to signalling the change of speaker and the interlocutor's wish to backchannel or contribute with propositional content. We are interested primarily in the relevance of prosodic cues in relation to textual ones, and their cross-linguistic validity by comparing unrelated languages Slovak and Argentine Spanish. Results of a perception study indicate that 1) in addition to textual cues, prosodic cues also play a clear role in perceiving how the dialogue will unfold; and 2) there exists a non-empty intersection of temporal and intonational prosodic turn-taking cues in the two languages, despite their belonging to separate families.

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## Faithfulness-boost effect. Skill acquisition improved by grouping strategies.

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It is widely stated that expertise is attained mainly by practice. Newell argued in 1981 that the generalized power law describes all the expected learning curves of the population. However, individual learning curves are more irregular and predicting them proved to be hard. Other components should be taken into account in order to better understand the learning processes. We focus on how the expected learning curve could be modified by different social strategies. Social learning is defined as long-term changes in behavior caused by stimuli derived from observation of – or interaction with – other individuals. Here we set to investigate the impact of team play strategies over skill acquisition from a turn-based strategy game where players can participate playing individually or in teams. We found a “faithfulness-boost effect” that provides a skill boost during the first games of experience that would be acquired only after thousands of games of practice. Evidence leaves important open questions that may have practical implications for planning training strategies on educational systems, currently based on individual work.

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# Adaptation Approaches for Pronunciation Scoring with Sparse Training Data

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In Computer Assisted Language Learning systems, pronunciation scoring consists in providing a score grading the overall pronunciation quality of the speech uttered by a student. In this work, a log-likelihood ratio obtained with respect to two automatic speech recognition (ASR) models was used as score. One model represents native pronunciation while the other one captures non-native pronunciation. Different approaches to obtain each model and different amounts of training data were analyzed. The best results were obtained training an ASR system using a separate large corpus without pronunciation quality annotations and then adapting it to the native and non-native data, sequentially. Nevertheless, when models are trained directly on the native and non-native data, pronunciation scoring performance is similar. This is a surprising result considering that word error rates for these models are significantly worse, indicating that ASR performance is not a good predictor of pronunciation scoring performance on this system.

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# Application of State Quantization-Based Methods in HEP Particle Transport Simulation

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Simulation of particle-matter interactions in complex geometries is one of the main tasks in high energy physics (HEP) research. An essential aspect of the task is an accurate and efficient handling of particle transport and crossing volume boundaries within a predefined (3D) geometry and a magnetic field.

The Quantized State Systems (QSS) family of numerical methods provide attractive features for these types of problems, such as a dense output, which consists in sequences of polynomial segments whose coefficients change only at discrete events, and lightweight detection and handling of boundary crossings based on explicit root-finding of polynomial functions.

In this work we present a performance comparison between a QSS-based standalone solver and combinations of standard fixed step 4th order Runge-Kutta (RK4) and adaptive step RK4/5 methods in the context of Geant4. Results showed speedups up to 8x in case studies for a single particle oscillating harmonically in the x-y plane with a uniform B field in the z plane, with up to 200 crossing planes.

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# Behavioral semantic differentiation of API versions using enabledness-preserving abstractions

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En este trabajo estudiamos refinamientos de abstracciones basadas en habilitación (EPAs) con el objetivo de aumentar su sensibilidad a cambios/errores en código manteniendo algunas buenas propiedades de la abstracción: entendimiento y sobre-aproximación del comportamiento del protocolo. Para ello fue necesario i) reformular la definición de EPAs para soportar errores y comportamiento excepcional, ii) llevar a cabo experimentos empíricos para evaluar la sensibilidad utilizando fallas artificiales (mutantes de código).

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# Towards a Scalable Platform for Distributed Parallel Simulation of the ATLAS TDAQ Network

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The Trigger and Data Acquisition (TDAQ) network in the ATLAS experiment constantly updates its hardware and control algorithms which affect the network topology and data flow. Big structural changes are scheduled for Long Shutdowns (LS) that require a redesign of the network and applications. The modeling and simulation of the TDAQ system has proven successful to assist its engineering and design processes, relying on the Discrete Event Systems Specification (DEVS) formal framework. PowerDEVS is a tool providing a very efficient core set of DEVS-based simulation algorithms. Yet, the models currently in use face new challenges. As the complexity of models increases more demanding simulations call for optimizing the use of available computing resources, and the experimentation process in general (e.g. parameterization, launching, monitoring, data collection, visualization). We present a work in progress for an advanced infrastructure to automate distributed and parallel executions of TDAQ simulations on heterogeneous pools of computing nodes. The new features consist mainly of three subsystems: 1) The Parameters storage system, 2) The Simulation Results storage system and 3) The Simulation Distribution management system. The new architecture will automate the distribution of simulations, enable a live monitoring of long simulations with dashboards, and improve the management of large sets of simulation parameters and results to simplify the post-processing of historical runs.

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# Inferencia de Tactus con Fundamentos Estadísticos para Tap-dancing

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El poster presenta un modelo de cognición del pulso de una canción. El modelo solo tiene en cuenta cuestiones rítmicas, ya que está orientado a la cognición de ritmos de tap-dancing. El principal enfoque del modelo es explorar qué posibles pulsos son más razonables para un pasaje rítmico a medida que se lo escucha. Esta información sirve para evaluar que tan certero es el mismo, si hay duda en la sensación de pulso y si la sensación del mismo cambia en algún punto de la canción. El modelo fue comparado con un trabajo anterior en tres datasets: un conjunto de canciones de música clásica sin error humano, un subconjunto de estas canciones interpretadas por personas y un conjunto de audios de tap.

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## Actualización dinámica de controladores discretos

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Podemos utilizar mucho tiempo diseñando el software deseado logrando un sistema robusto que se anticipa a todas las cosas malas que puedan suceder en run-time. Pero no importa cuanto tiempo utilicemos diseñando, siempre puede suceder algo en run-time que no esperábamos. ¡Algo inesperado sucede!

¿Cómo actualizar un software cuando algo inesperado en tiempo de diseño sucede en run-time y necesito cambiarlo?

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# Portable EEG system validation with ERP and resting-state paradigms, for it use in developmental contexts

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The electroencephalographical (EEG) level of analysis of cognitive development provides high-temporal resolution information of the neural activity underlying the dynamics of cognitive processes. Thus, such methodologies have important implications in building knowledge on cognitive development during childhood. However, EEG research is not generally applied beyond laboratory settings, adding some confounding factors, related to the new environment, and limitations, regarding the number of experimental sessions and the final sample size. Recently, low-cost portable EEG equipments are being released. These EEG systems usually comprise a smaller array of electrodes, transfer the data via wireless -at also smaller sample rates-, and require little adjustment and time-montage. Thus, they are ideal for the use outside the laboratory, for instance at school. In this regard, efforts aimed to transfer laboratory methodologies to different developmental contexts would pave the way for extending their inclusion in studies with greater ecological value.

We recorded EEGs with the research high-quality (Biosemi) and low-cost EEG (Emotiv) systems while participants performed active (Go/NoGo) and passive (cartoon video) tasks. Amplitude and latency analysis were performed on early ERPs (N1, P2, N2) in the active task, whilst frequency spectrum and temporal correlations of the baseline EEG activity were examined in the passive task.

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# A block-based programming learning tool to support challenge-based learning

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Pilas Bloques is a scenario-based, children learning platform built to support Argentina's nationwide Computer Science at school initiative. Besides a number of technical features like working offline and being light on resource consumption, it proposes a pedagogical strategy based on inquiry-based learning, decomposition, short and focused challenges and abstraction building. Pilas Bloques can be seen as a complementary tool to the well-known tool Scratch.

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# Minimal Unit Circular-Arc Models Are Integer

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Un modelo arco-circular (CA) es un par  $M=(C,A)$  tal que  $C$  es un círculo y  $A$  una familia finita de arcos de  $C$ . Suponemos que  $C$  tiene un punto especial, denotado por  $0$ ; cuando  $0$  no pertenece a ningún arco de  $A$ , decimos que  $M$  es de intervalos (IG). Los modelos UCA y UIG se corresponden a los modelos CA e IG cuyos arcos tienen todos la misma longitud, respectivamente. Dos modelos CA son equivalentes cuando los extremos de sus arcos aparecen en el mismo orden en un recorrido de sus círculos desde  $0$ .

Un modelo IG  $M$  es  $(l, d)$ -IG cuando sus arcos tienen longitud  $l > 0$  y cada par de extremos está a distancia al menos  $d > 0$ . Decimos que  $M$  es  $(\infty, d)$ -minimal cuando, para todo modelo  $(l', d)$ -IG  $M'$  equivalente, ocurre que: 1.  $l \leq l'$  y 2.  $s_i \leq s'_i$  para  $i$  entre 1 y  $n$ , donde  $s_i$  (resp.  $s'_i$ ) es la posición del  $i$ -ésimo extremo de  $M$  (resp.  $M'$ ) desde  $0$ . Pirlot demostró que todo modelo UIG  $M$  es equivalente a un modelo  $d$ -minimal y que  $l$  es múltiplo de  $d$  cuando  $M$  es  $d$ -minimal.

Un modelo CA  $M$  es  $(c, l, d)$ -CA cuando el círculo tiene circunferencia  $c > 0$ , los arcos tienen longitud  $l > 0$  y los extremos están a distancia al menos  $d > 0$ . Decimos que  $M$  es  $d$ -minimal cuando, para todo modelo  $(c', l', d)$ -CA equivalente, 1.  $l \leq l'$  y 2.  $c \leq c'$ . Todo modelo PIG  $(\infty, d)$ -minimal es  $d$ -minimal, pero la recíproca es falsa. Soullignac para demostró que todo modelo UCA es equivalente a un modelo  $d$ -minimal y conjeturó que  $l$  y  $c$  son múltiplos de  $d$ . En este trabajo mostramos que en efecto lo son.

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