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Relate [...] to [...] logic or [...] CSP

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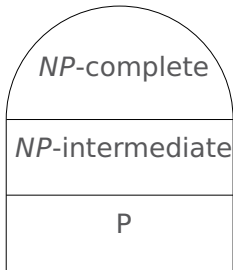
ANR δ ifference



CSP and dichotomy



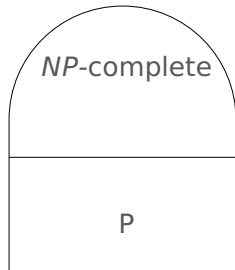
Real World¹



Ladner's theorem ['75]



CSP world



Feder et Vardi Conjecture ['93]
Bulatov and Zhuk theorem ['17] 2/12

CSP ?

CSP enjoys many definitions including

- Model checking problem.
- homomorphism problem.

Model Checking

Structure \models a sentence?

primitive positive

e.g.



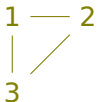
$\exists x_1 \exists x_2 \exists x_3 \exists x_4 E(x_1, x_2) \wedge E(x_2, x_3) \wedge E(x_3, x_4) \wedge E(x_3, x_1)$

Model Checking

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primitive positive

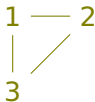
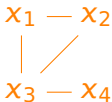
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Homomorphism

Structure has a
homomorphism to another
structure?



Classification

Structure \models a sentence? Structure \rightarrow Structure?

Fixed Parameter
Input

Dichotomy : for each parameter the problem is either tractable (Ptime) or hard (NP-complete).

Interesting Examples

- up to the encoding using clauses rather than boolean relations, SAT is a CSP
- graph colorability
- transitive tournament

Feature of CSP

Monotonicity

If you remove a constraint from an input that is accepted, it remains accepted.

No machine characterisation

But we have algebraic characterization.

logic ?

Fagin ESO = NP

Feder and Vardi :
syntactic fragment of ESO
MMSNP " = " CSP

a question

investigate a suitable ODE
characterisation for the class
of CSP

ODE Currently

For FPTIME.

- well chosen class of ODE intrinsically computable in Ptime (\mathbb{DL})
- problem in FPTIME viewed as Register machine is compiled into a linear length ODE

FNP is defined as verification in FPTIME

CSP to ODE ?

CSP is very combinatorial / descriptive in nature.
There is no known crisp machine characterisation.
We know that nice algebraic properties imply tractability.

In practice we have **two algorithms** for Ptime CSPs, but for contrived theoretical examples that mixes both aspects.
In essence :

- Algorithm 1 : consistency "datalog"
- Algorithm 2 : compression to "span" of partial solutions

Proposed approach : explain algorithms as suitable change of variables in the ODE framework.