Test methods for Score-Based Interactive Music Systems

Clément Poncelet  Florent Jacquemard  
(Clement.Poncelet@ircam.fr)  (Florent.Jacquemard@inria.fr)  

INRIA Mutant Project Team - (UMR-9912)  
IRCAM - 1 Place Igor-Stravinsky 75004 Paris  

Manual piece preparation

Compiling Score into Intermediate Representation

Toward a formal Specification

Intermediate Representation

Model Based Test Generation

How be sure of a Score-Based Interactive Music System’s behavior during shows?

Ensuring a “guarantee” on the behavior of a complex real-time system is not trivial and requires formal method. Today, Antescofo’s behavior is “manually” checked by the composer during rehearsals. Since rehearsal performances represent just a few set of all possible interpretations of a score, this method is not rigorous.

The Intermediate Representation is a step toward a formal specification of Antescofo’s expected behavior. It is a model of how Antescofo’s reactive engine should compute its timed output for every inputs (i.e musician performances). IR can be represented with Extended Timed Input/Output Labelled Transition Systems. Each system starting at its s0 or s1 state and waits on an edge δ for a fire of δ of the symbol δ. IR is able to specify multi-clocks, concurrences, dynamic variables...

Existing tools for testing real time systems, with an automatic test cases generation, are based on the model of network timed automata (TA). IR are translated into TA straightforwardly, at the price of expressiveness loss. A set of artificial musician performances is automatically generated, with a cover guaranty (i.e quality of tests). The conformance of real traces to the formal model allows us to increase the guarantee on the stability of Antescofo at execution time.

Artificial rehearsals

Test cases

Real output trace

Expected output trace

Generated input trace

Some generated input traces

Environment model

Observable I/O

Event proxy model

Input events

Killable

Output messages

Input Audio

musician

Output Messages

audio softwares

MAX / PD

Time Line

Performance/Show time

Checking ?

Not very rigorous

Score follower

Listening

Antescofo

Composition time

Mixed score

requirements

verification

models of groups with “loose” synchronization strategy

models of groups with “tight” synchronization strategy

models of groups

Translating into standard formal models
(i.e Timed Automaton used by the Uppaal verification suite for realtime systems)

Timed Automaton

Committed states

Tests cases

Traces suite generation and translation

Tempo Curves

Project ANR-12-CORD-0099